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THE NEW YORK CABLE RAILWAY.

For several months a cable railway has been running steadily and without interruption of any kind on 10th Avenue, this city, from 125th Street north for a distance of about 3¼ miles. The massiveness of the machinery, the admirably planned and handsome building in which it is placed, and the smoothness with which everything works, justify us in presenting a somewhat detailed description.

This system differs in many essential points from those in use elsewhere, and is so designed, by means of duplicate cables and independent engines and driving gear, as to insure the continuous operation of the road under all probable conditions arising from accidents of any nature. In a city like New York, a great many street car lines are operated continuously during the day of twenty-four hours; and as it is impossible to get machinery and wire ropes that will run forever, without stoppage for repairs, it becomes almost absolutely necessary that some plan of duplication should be adopted. We therefore find that the principal characteristic of this system is of course the double line of cables that run side by side through the trenches; while one of these cables is working the other is held as an auxiliary, or reserve, only to be called into operation should anything disable the first. The machinery is so arranged that the load can be easily and quickly transferred from one rope to the other, and the grips on the cars are made double, so as to take hold of either rope as occasion requires. This method not only insures the uninterrupted operation of the road, but also provides for a careful inspection of either rope and the repairing of either whenever necessary. It allows the cables to be operated alternately for twenty-four hours, thereby providing time to make repairs to machinery or ropes; the change of ropes causes no interruption to travel.

The engine room, of which we present two views, one looking toward the street and the other toward the rear, is occupied in the portion next to the street with two Wright automatic cut-off engines, which may be used either together or independently. Each engine is of 300 horse power, the cylinders being 28 inches in diameter by 48 inches stroke; each flywheel is 18 feet in diameter and weighs 40,000 pounds. Upon each engine shaft is a gear 6 feet in diameter and 18 inches face, meshing with a gear 13 feet in diameter on the line shaft. (For convenience of description, we will consider the machinery driving the drums over which the cables pass as being divided into two sections, one at each side of the engines.) This shaft is 12 inches in diameter and 100 feet long, and at the center is provided with a coupling, in order that either side or section can be operated independently of the other and by either engine.

The shaft revolves in ten bearings, and drives at each section a system of gearing carrying two sets of cable drums. As will be seen from the engravings, particularly the enlarged view of one of the sections, Fig. 3, the gearing is placed in the center of a rectangular space, upon each long side of which are two drums working together. Thus there are four sets or pairs of drums, each pair with its own cable, and either of which can be operated independently of the others, or all may be worked at the same time. The two cables of the same section constitute the double ropes that pass over the same route and with-

(*Continued on page 70.*)

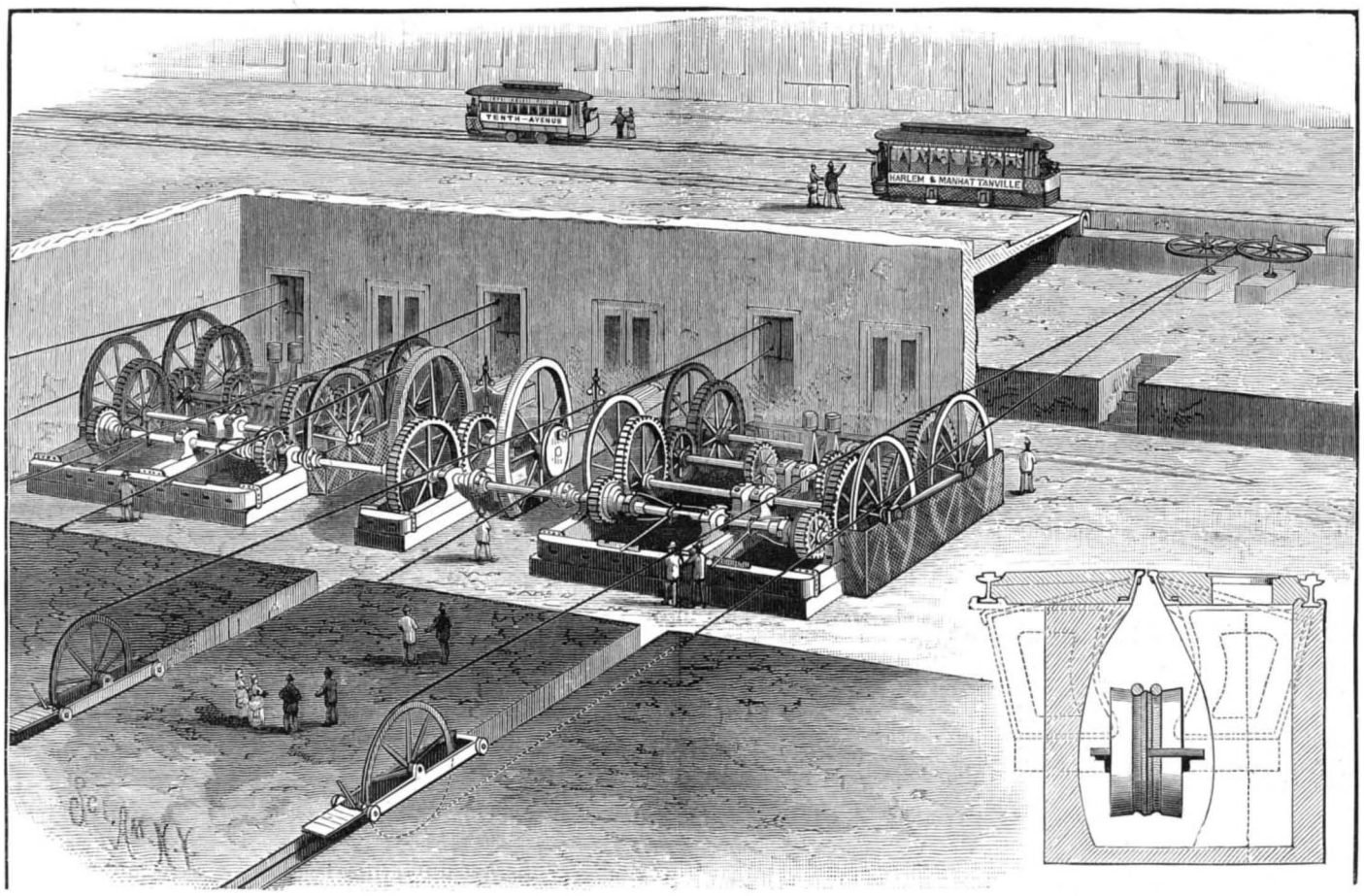

FIG. 2.—VIEW OF OPERATING MACHINERY.—LOOKING TOWARD THE STREET.

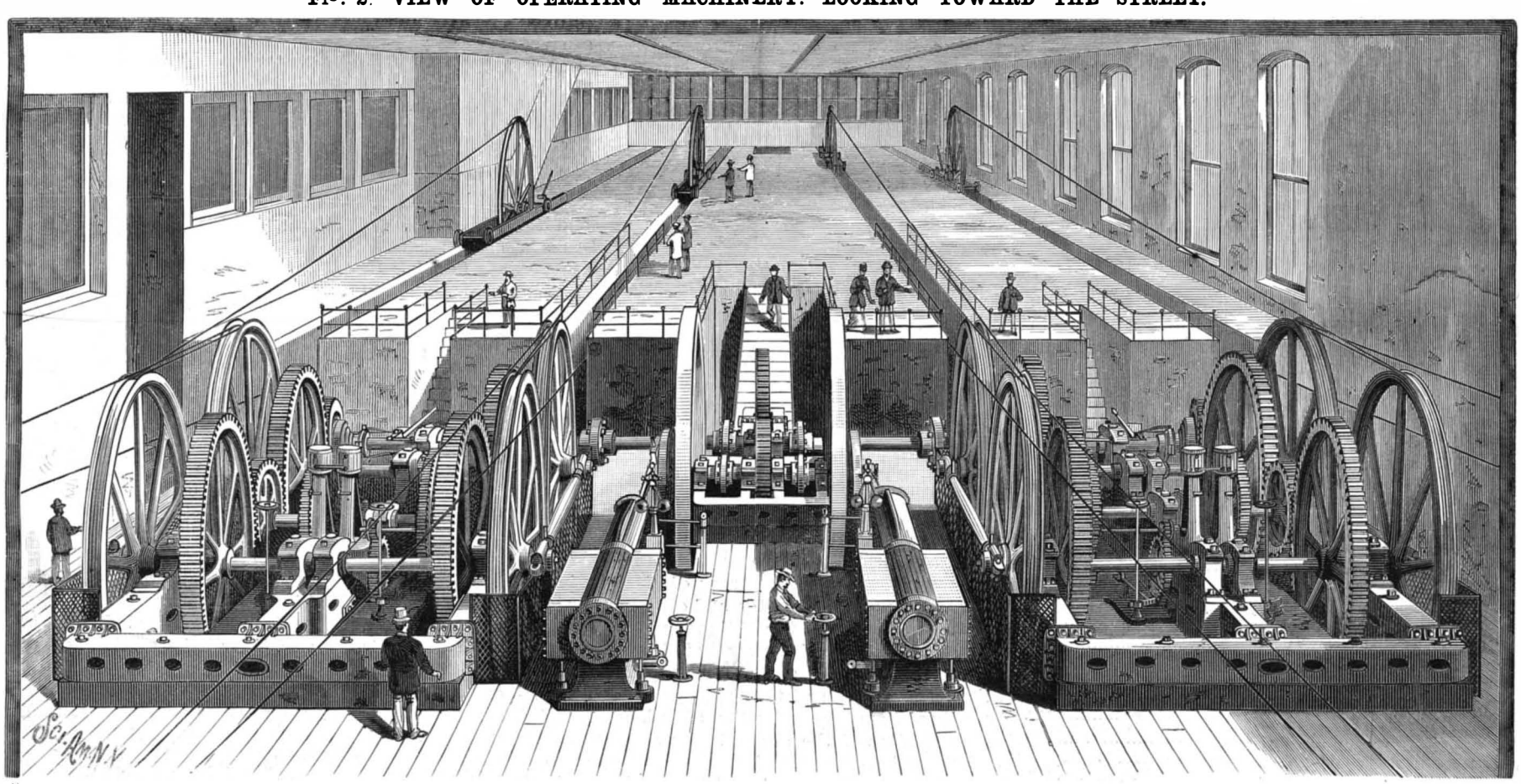

Fig 1.—OPERATING MACHINERY OF TENTH AVENUE CABLE RAILWAY, NEW YORK CITY.—LOOKING TOWARD THE REAR.

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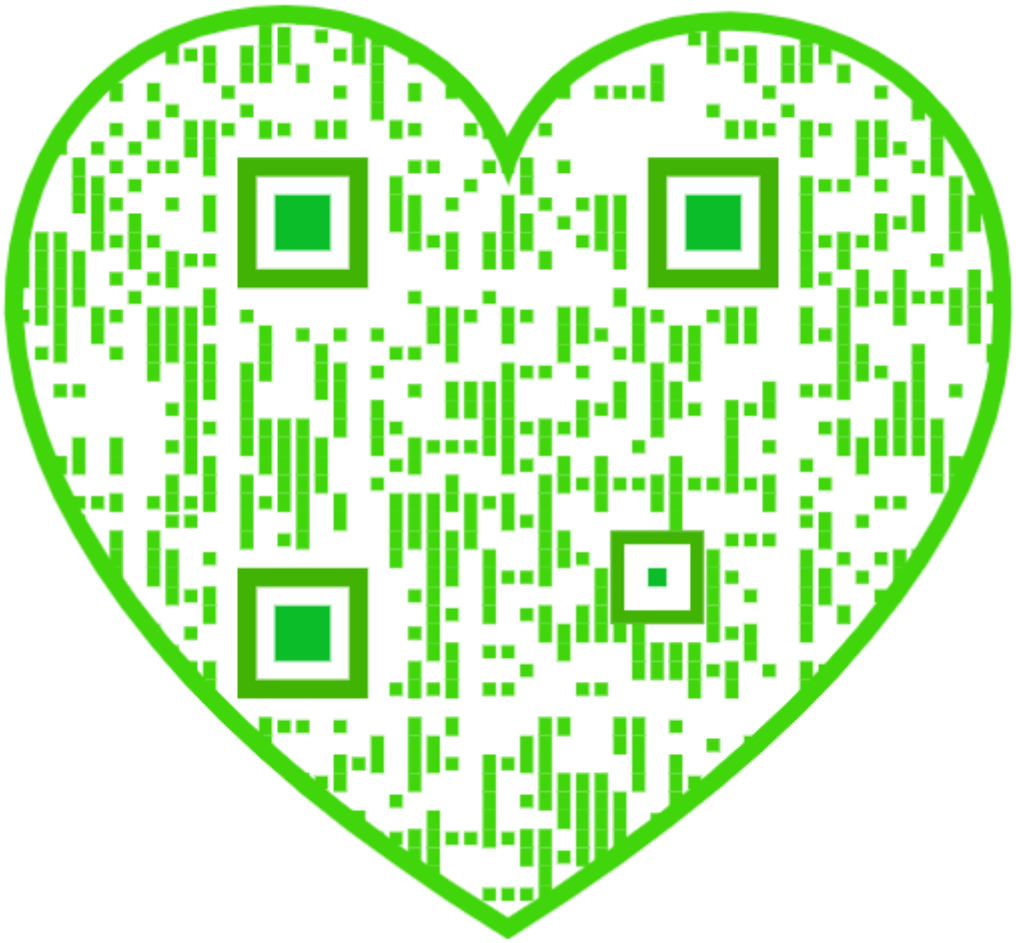

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NEW YORK, SATURDAY, JANUARY 30, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Boards and pamphlets perforated by the Termes flavipes*..... 71
Books and publications..... 74
Business and personal..... 74
Butchers, feathered*..... 71
Cable, anti-induction, Waring.... 69
Cable railway, New York*.....63, 70
Canal, Panama, the..... 67
Canal, Suez, navigating by the electric light..... 73
Comet, how an astronomer captured a..... 72
Deafness, instrument to relieve, prize for..... 65
Engineers, Civil, American Society of..... 65
Fans, whittled*..... 73
Fire from steam pipes..... 69
Fireproof construction..... 67
Furnaces, feeding coal to, apparatus for*..... 66
Gas, illuminating, apparatus for making*..... 66
Gold, dissemination of, natural... 69
Hughes, Prof., honors to..... 68
Hydrogen, weight of..... 64
Inventions, agricultural..... 74
Inventions, engineering..... 74
Inventions, index of..... 75
Inventions, miscellaneous..... 74
Lectures, Sibley College, Cornell University..... 64
Life, success in, conditions of..... 68
Manufacturers and machinery.... 67
Micro-audiphone, Blodgett's*..... 66
Milling and slotting machine, combined*..... 67
Notes and queries..... 74
Ocean bottom, how it is lighted... 72
Patents, decisions relating to, notes of..... 65
Photographic notes..... 65
Photo printing by machinery..... 73
Plant, best, for holding banks..... 73
Pneumonia, house, epidemic of.. 65
Railway, cable, New York*.....63, 70
Register, patent, ruined by..... 72
Snow in streets, melting, steam heat for..... 64
Spontaneous combustion, case of. 69
Steam, making, by friction*..... 70
Steering by electricity..... 64
Telephone patent, Bell, suit against, the Interior Department favors a..... 64
Telephoning from lightships..... 68
Termes flavipes*..... 71
Torpedo experiments..... 73
Whaling interests, California..... 66
Writing materials, manufacture of 68

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 526

For the Week Ending January 30, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY.—Calorific Power of Fuel.—Formulas for calculating the same..... 8398
The Determination of Phosphoric Acid in Commercial Fertilizers.—By J. S. ADRIANCE..... 8399

II. ENGINEERING AND MECHANICS.—Mechanical Water Cooler.—With engraving..... 8394
How Solid Cast Iron floats on Melted Iron.—With engraving..... 8394
Report of the Committee on a Uniform System for Tests of Cement.—From the Transactions of the American Society of Civil Engineers.—Tests of cement.—Fineness.—Checking or cracking.—Mixing, etc.—Sampling.—Sieves.—Standard Sand.—Moulds.—Clips.—Machines..... 8395
Supplementary Rudder for Use on the Suez Canal.—Invented by Capt. DECERFZ..... 8402
Coal Boring Machines.—The "Ratchet," the "Little Tiger," the "Universal," the "Acme"..... 8403
Sibley College Lectures, by the Cornell University Non-resident Lecturers in Mechanical Engineering.—II. By J. C. HOADLEY.—Fire considered as a practical source of heat..... 8403
Repairing Broken Crank Shafts.—2 figures..... 8404

III. TECHNOLOGY.—Hydrocarbon Furnaces for Dental Operations.—By Dr. C. H. LAND.—Gasing the body and enamel.—Olefiant gas and gasoline.—1 figure..... 8394
The Manufacture of Toilet Soaps.—By C. R. ALDER WRIGHT.—Different tests.—Combined alkali.—Determination of glycerine.—Classification of toilet soaps in accordance with the results of chemical analyses..... 8397
Cocoanut Fiber.—Importation of the nuts.—Removing the husks.—Process for converting the husks into fiber..... 8405

IV. MAGNETISM, HEAT, ETC.—The Wenham Light.—A new lamp for the consumption of common gas.—2 figures..... 8404
The Influence of Magnetism upon the Character of the Spectral Lines.—By CH. FIEVEZ..... 8404

V. ARCHITECTURE.—Preservation of Building Materials by the Application of a Paraffine Wax Compound, as Recently used upon the Egyptian Obelisk, Central Park, New York.—By R. M. CAFFALL.—From a paper read before the N. Y. Academy of Sciences.—With engraving..... 8391
Hollow Bonds.—Bonds for cheap brick walls.—2 figures..... 8399
The Equilateral Arch.—With illustration..... 8399
Longleat.—An English country residence.—Seat of the Marquis of Bath.—With full description of the house, grounds, fruit houses, etc., and an engraving..... 8400

VI. AGRICULTURE AND HORTICULTURE.—The Evans Combination Agricultural Implement.—With three engravings..... 8402
The Japanese Persimmon.—The different varieties of kakis.—With engraving..... 8406

VII. MISCELLANEOUS.—Correspondence through Pigeons.—Organization of cotes.—Rearing and training.—System of correspondence. 8394
The Cochineal Industry in Guatemala..... 8396
The Best Kind of Drummer..... 8401
Two Games.—Tossing the ring.—The game of boccia.—2 figures... 8406

THE INTERIOR DEPARTMENT FAVORS A SUIT AGAINST THE BELL TELEPHONE PATENT.

In the matter of the application made to the Department of Justice to have a suit brought to annul the Bell telephone patent, which application was referred to the Interior Department for preliminary inquiry, Mr. Lamar, the Secretary of the Interior, has at last promulgated the result of his deliberations, which he summarizes as follows:

"The grounds of invalidity alleged against the Bell telephone patent may be substantially summarized thus:

"First.—The patent was procured by the fraud of the patentee through the collusion or mistake of the officers of the Patent Office, and in violation of the rights of a caveator named Elisha Gray.

"Second.—The invention patented was not patentable, because already public. Referring to what I have said under the other head of inquiry, it is apparent that these allegations describe the occasions in which the Government, upon my view, ought to actively interfere for the cancellation of a patent.

"It is manifest that a decision upon the merits of the controversy, as to the validity of the patent, is not embraced within the terms of your request. The issue before me lies outside of the ultimate merits of the case as a subject of judicial investigation. As to what the final judgment should be I have not felt called upon to form (and if I had formed, I would not express) an opinion. The question is whether enough has been shown upon the hearing to require the submission of the matter to the court at the instance of the Government. The proof adduced in support and defense is very voluminous, and very conflicting in many respects. It involves great scientific research and detail, and perhaps some intricate legal questions. The allegations and the evidence touching the circumstances attending the issue of the patent are of such a nature and have such a support as to render it, in my opinion, improper to ignore or dismiss them. Such a case is presented as, I think, ought to undergo thorough judicial investigation. It appears that many suits have been pending and many are now pending between the corporation claiming this patent and others that assail it. In none of these cases has there been, or can there be, as I think, such thorough investigation and full adjudication as to the alleged frauds or mistakes occurring in the Patent-Office, in the issuance of the patent, as could be had in a proceeding instituted and carried on by the Government itself. In a case involving such questions, it seems to me especially imperative upon the Government, as duty to its own officers to vindicate or condemn, and duty to the people, to set on foot and follow up a complete investigation. In my opinion the proceeding should be in the name and wholly by the Government, not on the relation or for the benefit of all or any of the petitioners, but in the interest of the Government and the people, and wholly at the expense and under the conduct and control of the Government. I think it should be instituted at such point and in such court as will best subserve the purposes of public convenience and full inquiry. Such a proceeding, so conducted, will, as I think, comport with the dignity of the Government and the gravity of the subject, and will insure a final and just adjudication of the merits of the controversy."

It is to be hoped the Department of Justice will coincide with the above views, and order the suit to be commenced. In no other way, apparently, can the real facts concerning the invention of the telephone be judicially determined.

SIBLEY COLLEGE LECTURES, CORNELL UNIVERSITY.

We have received from the director of Sibley College, Cornell University, and publish in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, a second lecture of the course given by the non-resident lecturers to the associations of students in the courses of engineering and architecture. This lecture will be found to be quite different in its character from that delivered by Dr. Raymond, and published as the first of our series. Though less eloquent, it is as full of information as an egg is full of meat, and, in that sense, is as thoroughly satisfying. It is a simple, straightforward talk upon the subject chosen—a subject with which, probably, no member of the profession is more familiar than the lecturer. Mr. Hoadley is considered to be perhaps the best authority known in this country upon the practical application of the scientific principles of combustion, and of transfer and utilization of heat, and has attained an enviable reputation for the exceptional completeness and accuracy of his work in the determination of the economy and efficiency of steam boilers. He has earned the distinction of having been the first to make what is now regarded by engineers as a thoroughly complete and satisfactory investigation of the whole problem of the development and utilization of heat from the combustion of fuel, as illustrated in the operation of the steam boiler, and to give an exact account of its production, distribution, and disposal. The scientific aspect of his work is considered as satisfactory as the technical. The most striking feature of his work generally is its precision and the scientific accuracy of its presentation.

Mr. Hoadley is one of the most experienced engineers in the United States, and has been well known for many years as a mechanic, a builder of engines of high grade, and as an expert. He is a prominent member of the Society of Mechanical Engineers, and was one of the committee which prepared the recent important and valuable report to that body upon the standard method of trial of steam boilers.

The editors of this journal have arranged for the publication of the whole series of these remarkably valuable lectures and addresses.

STEAM HEAT FOR MELTING SNOW IN STREETS.

Referring to our article in last week's issue, it may be as well to add that the disposal of snow by steam heat is already successfully practiced in the business part of the city of London. Pits are provided, with steam coils at the bottom. Into these pits the snow is shoveled, and, being rapidly melted, is run through pipes into the sewers. Such pits might be available here, and steam for them could be supplied from the steam pipes now employed for conveying steam to a large part of the city from the boilers of the New York Steam Heating Company.

It is stated, with reference to the London system alluded to above, that it has proved to be a large economy as compared with the carting of snow from the streets, still used in many parts of London and in other European cities.

Weight of Hydrogen.

A paper was read before the British Association on "An Approximate Determination of the Absolute Amount of the Weight of Chemical Atoms," by Professor G. Johnstone Stoney, D.Sc., F.R.S., who showed that the mass of a molecule of hydrogen is a quantity of the same order as a decigramme divided by 10^{24}, *i. e.*, a twenty-fourth decigrammet, which is the same as the twenty-fifth grammet. (The grammets are the decimal subdivisions of the gramme, of which the first is the decigramme, the second the centigramme, etc.) The mass of the chemical atom of hydrogen may be taken to be half the twenty-fifth of the grammet. This value is based on the conclusion arrived at by several physicists, that the number of molecules in a cubic millimeter of a gas at ordinary temperature and pressure is somewhat about a unit eighteen—10^{18}; from which it can be shown that the number of molecules per liter must be about a unit twenty-four—10^{24}. From this, together with a knowledge of the weight of a liter of hydrogen, the above value for the mass of a molecule of hydrogen has been deduced. The mass of a molecule of hydrogen being known, it is possible now to determine approximately the masses of all other simple substances and of compounds also.

Steering by Electricity.

The old war vessel Tallapoosa, which has been undergoing a thorough overhauling at the Brooklyn Navy Yard, has among other improvements been supplied with an electrical steering apparatus, by which the ship guides her own course automatically. The tiller is operated by compressed air, governed by electricity from the pilot house, and can be turned from its extreme starboard to its extreme port position, or the reverse, in a fraction less than three seconds. The automatic action is obtained by means of an electrical mechanism, which is attached to the compass at the point to which it is desired to secure the vessel's course. This mechanism holds the ship to that point, the electric circuit being opened and shut by the motion of the vessel. The rudder is thus acted upon, and corrects any deviation from the marked course.

The inventor states that the introduction of electricity into the compass box has no influence upon the needle; but a great many mariners, we fear, will be apt to think that this is playing with fire. The pilot house is further equipped with an independent hand wheel, by which the course of the vessel, by the action of the current upon the compressed air cylinder, may, when desired, be changed from the set direction without disturbing the automatic device. By means of a small electric lever on the bridge, the officer in charge may, however, take instant command of the rudder and change the direction of the vessel at will. This does away with the man at the wheel of our former navigation. At the same time, the control of the ship is much more perfect.

OF the Ericsson new submarine gun, mentioned a fortnight ago in these columns, the *Naval and Military Gazette* says it is an object of much interest in English naval circles. But, it adds, the partially bald ones are fast losing their few remaining hairs scratching their heads over the puzzle how the India rubber diaphragm over the muzzle is to be replaced for the second charge, after the first has been fired away nine feet under water. Captain Ericsson will no doubt provide a means for accomplishing that, so the British officers had better spare their scalps till they hear further from the venerable inventor.

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PHOTOGRAPHIC NOTES.

Exhibition of Photographs at Philadelphia.—The recent exhibition held at Philadelphia, Pa., from Jan. 11th to the 16th, at the Pennsylvania Academy of Fine Arts, under the auspices of the Photographic Society of Philadelphia, was undoubtedly the largest display of amateur work yet seen in this country, comprising, it is estimated, over 1,750 separate pictures. It was open to both professional and amateur photographers from all parts of the world; but very little professional work was noticed, and, such as it was, was of excellent quality.

The western views by Mr. W. H. Jackson, Denver, Col., were remarkable for their large size and clearness, and included work made from paper negatives. Mr. Gutekunst, of Philadelphia, had on exhibition his immense panoramic view of the 1876 Centennial Exhibition, about eight feet long by two feet wide, printed upon one sheet of paper, from seven negatives; also a fine panoramic picture of the Capitol at Washington.

Specimens of his fine photo-engraving work were also to be seen.

Mr. Fred. E. Ives exhibited specimen orthochromatic photographs made by his improved chloro phyl process, which attracted attention for the great amount of detail noticeable in the red and yellow portions of the pictures; there were also examples of the Ives process of photo-engraving.

The large assortment of views, mostly direct prints, but including one or two enlargements made upon the new Eastman gelatino-bromide paper for positive printing, by Mr. Wm. H. Rau, of Philadelphia, were extremely clear and good, and specially interesting from the fact that they were the first general exhibition of this class of work in this country. When it is considered that most of the prints were made, perhaps, at night by an artificial light, the possibilities and advantages of the paper for obtaining prints from negatives with a printing-press rapidity, independent of sunlight, at once becomes manifest.

There appears to be a large future in store for this paper; its excellent keeping qualities, easy and quick manipulation, make it at once superior in many classes of work to the ordinary albumen paper.

Excellent specimens of platinotypes were shown by Mr. William Willis, of Bromley, England. We also noticed some beautiful examples of instantaneous marine views sent from England, by G. West and Sons, of yachts flying through the water sped on by a stiff breeze, and yachts in tow, with sails spread.

Both pictures were remarkable for their clearness and crispness, being also extremely sharp; every line and peculiar curve of the white foam, as well as the hull and rigging and sails of the boats, was wonderfully distinct and natural.

Mr. Pepper exhibited many curious instantaneous photographs of athletes in various positions; one or two of his best pictures illustrated a man in the act of making the high jump, for example, just as he was about to pass over the bar. The peculiar attitudes shown were novel and interesting, illustrating, as they did, that the negative plate often catches movements which are too quick for the eye to perceive.

A frame of photographs by Dr. Ellerslie Wallace, including many views of English scenery, castles, and old abbeys, was particularly fine. The point of view was well chosen, and the work, technically, all that one could wish for.

A number of views taken in India of the Calcutta Exhibition, by Mr. C. R. Pancoast, were much admired on account of their clearness, good lighting, excellent choice of point of view, and fine technical qualities.

Artistic landscapes were shown by Mr. Robert S. Redfield, the secretary of the society, and deserved the prize awarded him. Both Mr. Frank Bement and J. C. Browne had a number of fine pictures, the latter showing a view of a catalpa tree in full bloom on the Hudson, the detail and lighting being excellent. The negative from which the print was made was by the old wet-plate collodion process.

We also noticed some excellent work sent by Mr. John E. Dumont and Frederick A. Jackson, members of the New York Society of Amateur Photographers, Mr. Dumont taking a prize for a beautiful Niagara winter scene. Mention should be made of an attractive composition picture entitled "The Village Smithy," by W. L. Shoemaker, of Philadelphia, in which the arrangement of the figures was extremely natural.

What an artist can do with photography was shown in the twenty pictures exhibited by Mr. George B. Wood; his particular specialty appears to be in the taking of single figures and groups, each of which is so lighted and composed as to tell the story intended.

All of his work, in this respect, was excellent, and was rendered more interesting by his happy faculty of giving each picture an appropriate and suggestive title.

Mr. J. P. Gibson, of Hexham, England, had on exhibition five or six pictures which had been awarded eight prizes at different English exhibitions. In them a very high standard of work was noticed.

Several ladies were among the exhibitors, their work being of excellent quality.

In lantern slides made on dry plates in which it was required that both the negative and slide should be made by the same person, the award of a prize was accorded to Mr. James E. Brush, of the New York Amateur Society. On the evening of the 14th, his slides, including over one hundred others, were thrown upon a large screen in a commodious hall on the ground floor of the main building. The lantern exhibition, which was well conducted, proved to be one of the most interesting and entertaining features of the entire exhibition, and comprised many beautiful pictures. A special double lantern, with a peculiar dissolving valve arranged between the two gas cylinders, instead of being attached to the lantern, the invention of Mr. Frank Bement, was used, and worked quite smoothly.

The managers of the exhibition are entitled to considerable praise for their enterprise in collecting and hanging such a formidable array of beautiful pictures. The interest in amateur photography will undoubtedly be extended by the continuance of similar exhibitions, which we hope will become more frequent. The display of fine specimens of any art is invariably instructive, and in no better way can the progress made in an art be made known than by a public exhibition.

American Society of Civil Engineers.

The American Society of Civil Engineers held its annual meeting on the 20th and 21st, at the Society's house, in New York City.

During the first day, sessions were held morning and afternoon, at which the reports of the Secretary and of the Committees on Technical Subjects were presented and discussed.

Prof. Eggleston, on behalf of the Committee on Standard Time, reported that the movement toward a continuous notation of the entire twenty-four hours was making gratifying progress. In time it will probably be adopted on all the leading railroads. The Canadian Pacific has already printed its time tables according to this standard.

A committee on rail and wheel sections was appointed. The Norman Medal was awarded to Mr. Eliot C. Clarke, of Boston, for his paper on cement, referring particularly to its use in the Public Works of Boston. The Rowland Prize was presented to Mr. A. M. Wellington, for his paper on the friction of journals. Prof. Eggleston gave the results of microscopical examinations of the stone of the obelisk. He attributes its decay to a very minute vegetable growth found some distance beneath the surface, but still containing sufficient chlorophyl to show a green color. Dr. Rothwell explained a new system of laying submarine tunnels. The summer convention of the Society was voted to be held at Denver.

In the evening Mr. B. S. Church, Chief Engineer of the Aqueduct Commission, explained the work now in progress on the new aqueduct and the proposed dam at Quaker Bridge. The second day of the meeting was devoted to a visit to the works themselves, Mr. Church acting as host. The sessions terminated with a reception and supper in the evening. The Secretary, Mr. Bogart, announced the Society to be in a very flourishing condition. The membership is between nine hundred and a thousand, the annual revenue about $20,000, and the total assets of the Society, including its comfortable house on East Twenty-third Street, are $48,000.

Notes of Decisions Relating to Patents.

In the U. S. Circuit Court, Southern District of New York, before Judge Wallace, the bill of complaint alleges infringement by the defendant of letters patent for a new and useful improvement in electric lights, of which Sawyer and Man were the inventors, bearing date May 12, 1885, granted to the Electro Dynamic Light Company, its successors and assigns, as assignee of Sawyer and Man. The application for the patent was filed January, 1880; in January, 1880, they assigned their whole interest in the invention to the Electro Dynamic Light Company; in April, 1881, that company assigned the invention to the Eastern Electric Manufacturing Company, and the Eastern Electric Manufacturing Company, in September, 1882, assigned the invention to the complainant. All these assignments were duly recorded in the Patent Office more than two years before the patent was granted.

The defendant has demurred to the bill, and the point raised is that the patent is void, because the Electro Dynamic Light Company, the grantee named in the patent, had assigned its interest to the complainant before the patent issued, and had no interest of record in the patent at the time the same was issued. The demurrer admits the validity of the assignments made by the Electro Dynamic Light Company to the Eastern Manufacturing Company and by the latter company to the complainant, and no question is made, or can be made, respecting their efficacy to invest complainant with the title of the Electro Dynamic Light Company to the invention. Judge Wallace overruled the demurrer, and holds that the title thus acquired by the complainant is as effectual to protect the defendant against any claims of the Electro Dynamic Light Company as if the assignment had been made by that company to the complainant after the patent had issued.

If the demurrer is good, the complainant, although the owner of the invention and the sole party entitled to enjoy the monopoly conferred by the patent, will be defeated because of the inadvertence or erroneous action of the Patent Office in issuing the patent to a corporation which cannot challenge the complainant's rights or assert any adverse claim against the defendant. It may well happen occasionally in the pressure of business at the Patent Office that an assignment made during the pendency of an application may be overlooked, although duly recorded, and the patent be issued to the inventor, or to an intermediate assignee whose assignment is on record. If, whenever this happens, the patent is to be deemed void, notwithstanding the title of the grantee named in it is instantly vested in the true owner by operation of law, and notwithstanding no possible injury or inconvenience can be occasioned to third persons or to the public, the result would be one of such unnecessary hardship that it is not reasonable to suppose that it could have been contemplated by Congress while framing the provisions of the patent laws.

In the U. S. Circuit Court, District of Vermont, in the case of the American Diamond Rock Boring Company *vs.* Sheldon *et al.* an arrangement of devices was described in an original patent, although it was not called a combination. Judge Wheeler held that a reissue calling it a combination, and containing a statement that the invention consisted also in this combination, does not appear to vary the prior description in effect.

If separable claims of the reissue cover the same invention as the original, and no more, such claims would seem to be as valid as the original, and would be infringed by whatever would infringe that.

The enlargement of the scope of a claim six years after the original patent is not valid according to the series of later decisions upon reissued patents.

The act of 1837 and the present statutes carefully limit the right of a party in an action to such material and substantial parts of the thing patented as could be definitely distinguished from the parts claimed without right.

The parts of the claims in this reissue which might cover the infringement are so blended with the other parts that they cannot be distinguished therefrom, and the bill must thereupon be dismissed.

A "House Epidemic" of Pneumonia.

Dr. Fr. Rudberg gives a brief account in the *Eira* of an epidemic of pneumonia occurring at the end of last year in a workmen's barrack at Sandarne, near Soderhamm, in Sweden, where there are five of these barracks, situated in a row, at a distance of a couple of hundred feet from one another on a piece of sandy soil near a pine wood. The epidemic was confined to one of these barracks, there being only a single case in the remaining four at the same time, and very few in the surrounding districts. This building was constructed of wood, and had sixteen rooms arranged in two stories, there being a common porch to every two rooms. Each room was occupied by a separate family. The total number of inhabitants was seventy-eight, of whom forty-seven were over fifteen years, and thirty-one under that age.

The first case occurred on November 16, in a boy of eight; subsequent cases occurred on November 27 and December 4, 7, 11, 14, 16, 19, and 20. Of these there were four males and five females, one boy and one girl being under ten, but all the rest between twenty and forty. Six cases occurred in the lower story, and three in the upper. The disease appeared to have no tendency to pass from one room to the adjoining one, or even to another room on the same story, and in no case was more than one inmate of a room affected; but one woman living at a distance, who occasionally visited some of those who had the disease, was attacked by it herself on December 14. It should be stated that there was plenty of intercommunication among the families. The writer does not mention any of the clinical characters of the epidemic.

Prize for Instrument to Relieve Deafness.

From the Boston *Medical and Surgical Journal* we learn that Baron Leon de Lenval, of Nice, has offered a prize of 3,000 francs for the best readily portable instrument, constructed according to the principle of the microphone, for improvement of hearing in cases of partial deafness. The committee consists of the following persons, to any one of whom instruments of this description, intended for competition, may be sent before December 31, 1887: Professor Hagenbach-Bischof, Ph. D., M.D., Chairman of the jury (Basle); Benni, M.D. (Warsaw); Professor Burckhardt-Merian, M.D. (Basle); Gellé, M.D. (Paris); Professor Adam Politzer, M.D. (Vienna). The prize will be awarded at the Fourth International Congress for Otology, to be held at Brussels in September, 1888.

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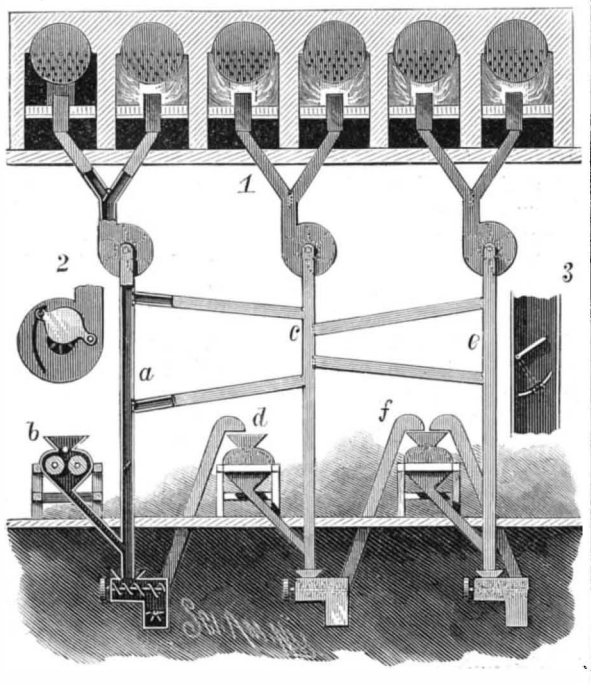
California Whaling Interests.

San Francisco is now one of the most important "whaling ports" in the United States. There has always been more or less whale fishing carried on at the stations along the coast, the product of which was marketed in this city, and this port has been an outfitting station for some few whaling vessels. But in the past few years the whaling fleet which is outfitted here has grown very materially. A number of the vessels are now owned here, among them the steam whalers, the best of the fleet. The Arctic Whaling Company have built large tanks for their oil on the bay shore, and the product is all handled here. The whalers that formerly outfitted at the Hawaiian Islands now come to this port. Oakland Creek is now a favorite wintering place for the Arctic whaling fleet. Some of the vessels leave here every fall to go to "the line" fishing, and then work up to the Arctic when the ice breaks up, returning here with their cargoes. The high price of bone of late has made the business very profitable.

The bulk of the oil is reshipped from here to the East, most of it going around Cape Horn in vessels. Of late, however, the railroad company has placed the freight rates at such a point that oil is shipped East by rail. One day recently the first shipment of whale oil for the season was sent from here. There were 17 car loads, or 460,000 lb. of oil. The train was a special one, and it was intended to make the unusual time of 12 days to New Bedford, Mass., the destination of the consignment. No transfers were to be made. The whaling business of this port is now very important. There is a great deal of money invested in it. The steam whalers were some of them built here. The business is one which adds greatly to San Francisco's industrial importance.—*San Francisco Ex.*

FEEDING COAL TO FURNACES.

The method of feeding coal to furnaces as herewith illustrated is designed to insure a more thorough combustion of the coal than has heretofore been obtained. A series of crushers, *b d f*, pulverize and then discharge the coal through branch ducts into the pipes, *a c e*, when the blowers placed at the upper ends of these pipes act upon it. The coal is first put into the crusher, *b*. After being pulverized, it passes through the duct to the pipe, *a*, where the suction current created by the first blower carries the finer particles up into its casing, and then by blast forces it through the forked distributing ducts against fire clay deflectors placed in the center of the fire chambers, just in advance of the bridge, where it is consumed. The large particles of coal, upon which the current has no effect, fall upon a screw in a receptacle at the lower end of the pipe, *a*, which carries them to an elevator which delivers them to the crusher, *d*, set to crush finer than the first one. The course of the coal after leaving this crusher is substantially the same as already described. If all the coal is not drawn up by the blower after leaving the



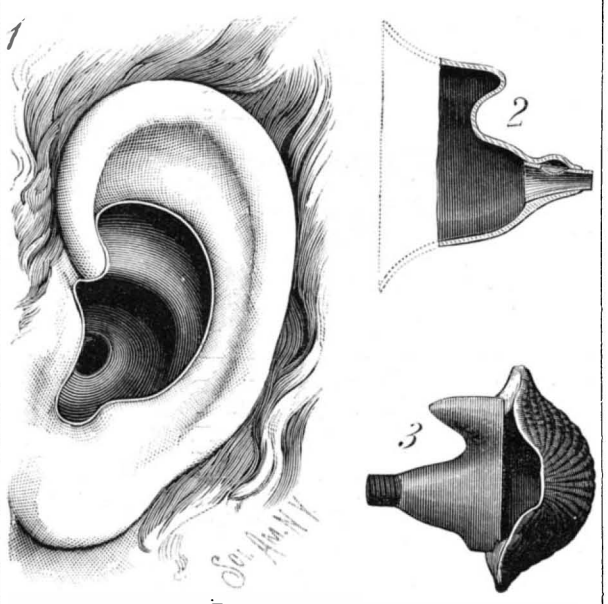
REHMENKLAU'S APPARATUS FOR FEEDING COAL TO FURNACES.

third crusher, *f*, it is carried back by an elevator for further crushing. The pipes, *a c e*, are connected together as shown, and at the junctions are placed valves; the branch pipes leading to the furnaces, and the main pipes, are also provided with valves. The free end of the rod operating the valve moves in an arc slot (Fig. 3), and can be locked in any position by a winged nut. By means of these valves the supply of pulverized coal can be cut off or admitted to any one of the furnaces. A detail view of one of the air inlet ports of the blower is shown in Fig. 2.

This invention has been patented by Mr. R. W. O. Rehmenklau, of 310 Plymouth Ave., Minneapolis, Minn.

THE MICRO-AUDIPHONE.

The accompanying engraving represents the micro-audiphone, the invention of Dr. F. M. Blodgett, of 207 West 34th Street, this city, which is designed to relieve deafness. The instrument is made of hard zylonite or other suitable material, and is formed to fit the ear, the shape being as clearly shown in the three views herewith presented. In the tube of the instrument is placed a membrane, or diaphragm, of very thin rubber or skin, held by the edges over a small chamber, as shown in the sectional view, Fig. 2. This diaphragm is by preference guarded by a small metal thimble placed in the tube, and formed



BLODGETT'S MICRO-AUDIPHONE.

with an opening to expose the diaphragm to the action of the sound waves passing through the tube. The action of the waves on the diaphragm causes it to vibrate, so that it has a "sounding board" effect, and augments the waves and renders the sound more audible. The device may be provided with a tubular portion to be held to the ear by the hand, and it may also be formed with an extending flaring section to collect the sound waves, like an ear trumpet, and direct them to the tube, as shown by the dotted lines. As indicated in Fig. 3, the device may be provided with a shell-shaped attachment, held detachably in place by its edges entering dovetailed grooves in the outer part of the main device. The sound waves enter the opening and strike the inner surface of the shell, by which they are guided directly to the opening of the ear. This attachment serves to collect the sound waves in a manner similar to the hand when held just behind the ear. The above-mentioned article has recently been patented in the U. S., Gt. Britain, and Canada.

APPARATUS FOR MAKING ILLUMINATING GAS.

The accompanying illustration represents an apparatus for some time past in operation at the Laclede Gas Works, of St. Louis, Mo., and we are assured that it has been in continuous operation, without one minute's intermission, since it was first started. A somewhat detailed description of the apparatus will be of interest to all concerned in the making of illuminating gas, because of the many valuable features introduced—all tending to simplify the construction, lessen the cost of the gas, and reduce to a minimum the labor necessary to operate it.

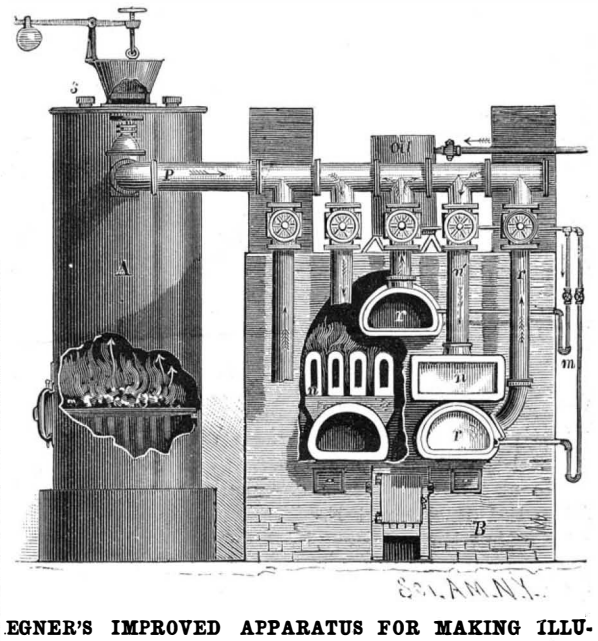
The generator, A, is provided with a door, fuel hopper, and valve, stoke and sight holes, *s*, and take-off pipe, P, leading through suitable valves and pipes to the fixing chambers, *n*. The bench of retorts, B, is such as is used in coal-gas works, except that in place of two of the ordinary retorts generally used there is set a series of fixing chambers, *n*, made of iron or fire clay. They are set on the tile on which the retort is usually placed, but, unlike the retorts, they run all through the bench lengthwise, and are connected at both ends with one common mouthpiece in batteries of four (more or less) to each mouthpiece.

Although retorts might be used instead of these narrow fixing chambers, they would not be as good in operation. It is the heated surface or wall of the fixing chamber which acts on the gas; and when a retort is used much of the gas passes through, if used as a fixing chamber, uncombined, for, gas being a poor conductor of heat, only those vapors near the walls are acted upon. For this reason these inverted U-shaped fixing chambers were devised. As will be seen by reference to the engraving, these chambers are set so that a series of them may be united at each end by one common mouthpiece, and that, for instance, as shown, four of these chambers have one common inlet pipe, *n'*, and also one common outlet pipe at their opposite extremities, or rear of the bench. The outlet pipes connect with a hydraulic seal, from which the gas is taken by an exhauster.

Gas may be made in the retorts independently of the generator, in the good old-fashioned way from coal, with this difference—that as the gas made would not go directly from the retort into the usual hydraulic main, but would have to pass first through the fixing chambers, the tar vapors, which condense soon after leaving the retort, would be subjected to additional heat at the time when they are in the best possible state to be acted on, viz., as vapors, thus adding greatly not only to the illuminating power of the gas produced, but to the volume as well. It will be seen, then, that the bench, as shown, may be used with advantage to make coal, oil, or wood gas, or a combination of all three, and with the best advantage.

The method of making water gas being well understood, it is not necessary to describe the generator here shown, except by the difference in operation from existing ones. Ordinarily, a bed of burning anthracite coal or coke is brought to a high heat by a forced blast; then the air is shut off and steam is admitted, which in passing through this incandescent mass is for the most part decomposed, forming what is generally termed water gas, which, in a subsequent stage, is carbureted to the required degree to form illuminating gas. During this operation the furnace door must be kept closed air tight; it is only opened when clinkering makes it necessary. Of course, the production of gas is intermittent; for while "blowing up," no gas is made for use. With the apparatus here described, all this is unnecessary. By opening the valve between the bench and generator, the same exhauster which takes away the gas from the retorts causes an in-draught of air at the generator door. Superheated steam, admitted under the grate of the generator, passes upward, and is decomposed the same as in the ordinary water-gas generator. The superheated steam, when once the generator is fairly started, seems to add to rather than take from the heat of this part of the apparatus. The fuel used in this case is ordinary Pittsburg gas coal, which, it is claimed, has never been used successfully in any other form of water-gas generator. The tar vapors from the coal add materially to the illuminating power of the gas made, since the gases in the generator as well as those in the retort must pass through the fixing chambers together.

This apparatus was at first designed as a mere auxiliary to the well-appointed coal-gas plant of the company in whose works it is now in operation; but it has proved itself so valuable that it is only a question of time when it will be the principal, and the regular coal-gas process the auxiliary. It is apparent that this apparatus can be easily applied to any style of coal-gas works, and it would be especially valuable to works in which it is found troublesome to supply the great demand made on their resources during the winter months. The bench here shown has produced 100,000 cubic feet of gas in twenty-four hours. It requires 5 gallons of naphtha or other oil, 11 to 14 pounds of bituminous coal, and 20 to 25 pounds of gas coke or other equivalent fuel to produce 1,000 cubic feet of gas. As stated above, the bench can be used either with or without the generator. The following simple enumeration of the operations necessary to run this apparatus clearly shows the small amount of attendance required, and will forcibly illustrate the difference between this and



EGNER'S IMPROVED APPARATUS FOR MAKING ILLUMINATING GAS.

other systems: Open the valves, start the oil, start the exhauster, feed the generator with gas coal about once an hour, feed the fire in the bench about once every forty-five minutes, and rake the ashes out of the generator occasionally. The first three are done once for all. This statement will be particularly appreciated by those familiar with the labor required in attending to other styles of apparatus.

All further particulars can be obtained from the inventor, Mr. Frederic Egner, Engineer of the Laclede Gaslight Company, of St. Louis, Mo.

ACCORDING to Prof. Langley, the inherent temperature of the moon is below that of melting ice.

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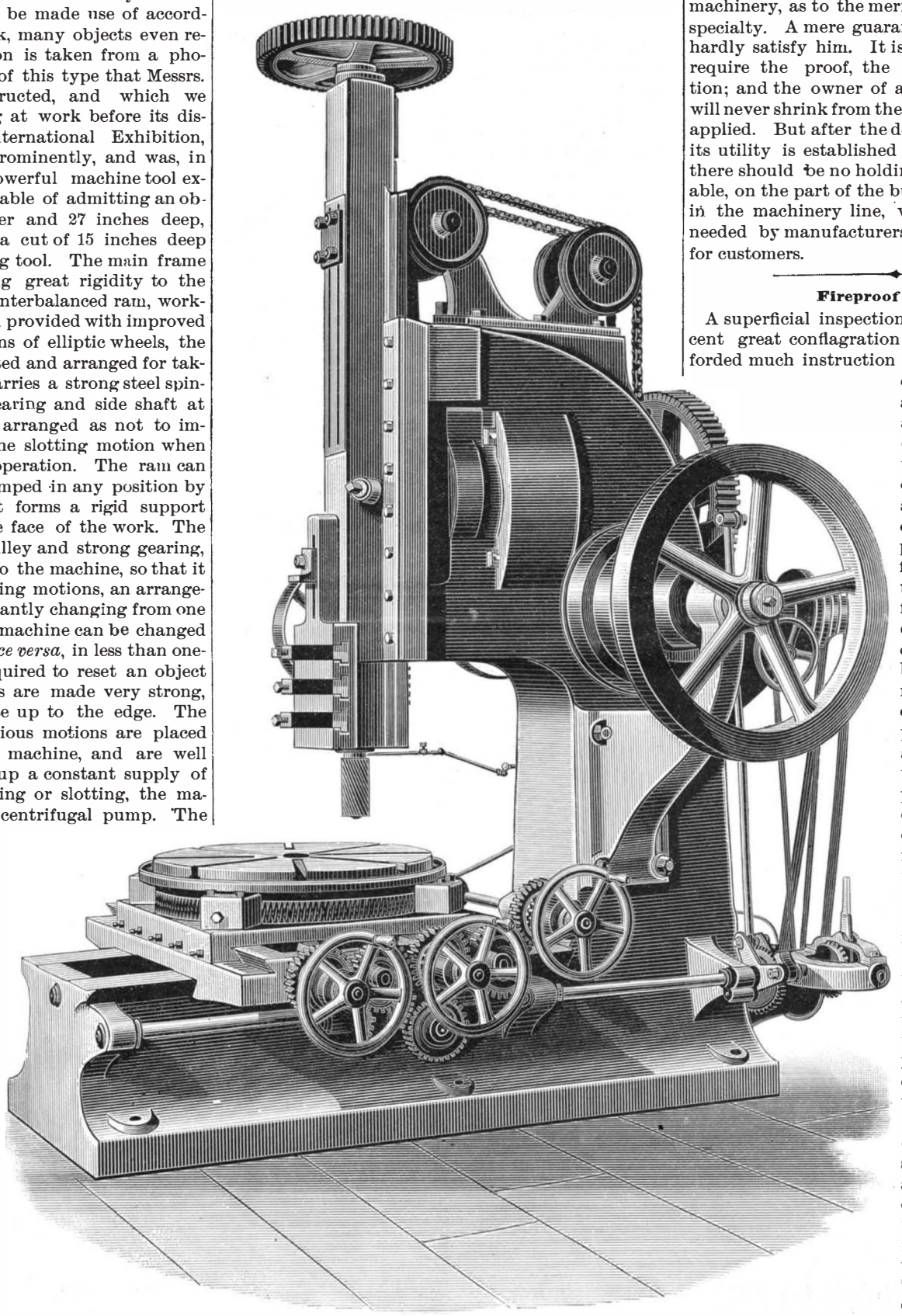
COMBINED MILLING AND SLOTTING MACHINE.

This is a new machine patented by Mr. Dixon, one of the partners in the firm of Kendal & Gent, Manchester, and it has been designed, says the *Engineer*, to combine in one machine the operations of roughing out objects with the slotting tool and afterward finishing them complete with the milling cutter, without the loss of time and, what is of still more importance, the risk of inaccuracy, due to the necessity, as hitherto, of changing and resetting work from one machine to another. A further advantage secured by the combination is that in medium sized works, where it is often difficult to find sufficient employment for a large machine adapted for slotting only, the addition of the milling motion gives so much more scope for the constant running of the machine; and, in fact, in any engineering works a combined tool of this class is more than doubly serviceable, as either operation can be made use of according to the nature of the work, many objects even requiring both. Our illustration is taken from a photograph of the first machine of this type that Messrs. Kendal & Gent have constructed, and which we had an opportunity of seeing at work before its dispatch to the Antwerp International Exhibition, where it has figured very prominently, and was, in fact, the largest and most powerful machine tool exhibited. The machine is capable of admitting an object 6 feet 2 inches in diameter and 27 inches deep, and it is adapted for taking a cut of 15 inches deep with either slotting or milling tool. The main frame is exceptionally strong, giving great rigidity to the whole, and carries a long counterbalanced ram, working in rectangular slides, and provided with improved quick return motion by means of elliptic wheels, the disk plate being well supported and arranged for taking up all wear. The ram carries a strong steel spindle for milling, driven by gearing and side shaft at the top, the whole being so arranged as not to impede in the slightest degree the slotting motion when this is required to be put in operation. The ram can be raised and lowered or clamped in any position by screw, so that when milling it forms a rigid support for the cutter quite up to the face of the work. The driving is by a large cone pulley and strong gearing, and is arranged transversely to the machine, so that it serves both milling and slotting motions, an arrangement being provided for instantly changing from one operation to the other. The machine can be changed from slotting to milling, or *vice versa*, in less than one-tenth of the time usually required to reset an object on another tool. The tables are made very strong, and are well supported quite up to the edge. The handles for working the various motions are placed together at the side of the machine, and are well under control. For keeping up a constant supply of lubrication when either milling or slotting, the machine is fitted with a small centrifugal pump. The total weight of the machine is about 11 tons.



COMBINED MILLING AND SLOTTING MACHINE.

The Panama Canal.

Dr. Arthur Gore returned recently from a trip through the United States of Colombia. Referring to the Panama Canal, he says that since the failure of the company to receive a new loan a spirit of demoralization seems to have settled down upon the whole enterprise. Nothing of any consequence is being accomplished at present.

Workmen are being discharged right and left, and auction sales of mules, carts, and other property are of frequent occurrence. It is said the sub-director-general intends to remove his headquarters to Colon, and that the Grand Hotel, built by the canal company, is to be sold. Nearly all the merchants of Panama hold "canal paper," as it is called, and the large owners are feeling very blue over the prospect in store for the enterprise. Dr. Gore is satisfied that the whole proceeding has been worked by egregious frauds from the beginning, and for the $120,000,000 already expended there is nothing to show in the way of a canal but a superficial scratch in the hard mass of volcanic rock through which it was proposed to cut a passage. Large sums of money have been spent in the construction of residences for officers, houses for workmen, hospitals, shops, tool houses, etc., nearly all of which were built by contractors who have bled the country most unmercifully. Some very handsome buildings and grounds now mark the line of the canal at the various points where it was thought best to begin operations. Gazing on these palpable evidences of extravagance, the French residents remark, "*C'est magnifique, mais ce n'est pas le canal*" [it is magnificent, but it is not the canal]. The surveyors' stakes were supplied under contract for $25 apiece, and all the other preliminary arrangements have been made on a scale and at a cost that would bankrupt a company with anything less than the "wealth of Ormus and of Ind" at its back.—*N. Y. Sun.*

Manufacturers and Machinery.

Men who conduct great business enterprises, says the *Manufacturers' Gazette*, are naturally conservative and averse to innovations and experiments. And yet it is through experimental knowledge, acquired by reducing theory to practice, that all progress in the useful arts is made. But it is not the business of the purely practical man to theorize; he is concerned only with actual results, and is satisfied to leave "well enough alone."

There are hundreds of fossilized mill owners who dread the appearance of the inventor with his new machine as the sick man dreads the potion of physic or the surgeon's knife which is to cure his infirmities and give him a new lease of life. He would rather be let alone and plod along in the same old beaten track which leads to no progress, provided his contemporaries in the same line of business are content to do the same. Even if it can be demonstrated that the new invention is one in the interest of true economy, and will pay for itself ten times over in the course of a few months, he is reluctant to investigate its merits, and don't care to experiment with it. He can only be interested on compulsion. Especially if its adoption would involve any considerable immediate outlay, he can't see any good in it, and won't touch it until compelled to do so by the action of some more enterprising and progressive rival, who "knows a good thing when he sees it," and who believes that "the best is the cheapest" in the long run.

It is undoubtedly true that the continual improvements in machinery involve frequent changes, which are sometimes expensive and burdensome to manufacturers.

Of course, we do not recommend the practical manufacturer to grab at every new patented machine which comes along, regardless of merit. While open to conviction and ready to investigate, he also needs to be cautious, deliberate, and discriminating in his action, in order that he may be sure to get the best, and not throw away his money on mere pretentious and catch-penny devices. There is no danger of his being deceived or imposed upon if his investigation is properly conducted. He is not called upon to take the word of any man, however well known or expert in machinery, as to the merits or capabilities of any new specialty. A mere guarantee of certain results should hardly satisfy him. It is not unreasonable for him to require the proof, the practical ocular demonstration; and the owner of any really meritorious patent will never shrink from the real test, however rigorously applied. But after the demonstration is complete and its utility is established beyond doubt or question, there should be no holding back, if terms a rereasonable, on the part of the buyer. A new and good thing in the machinery line, which is really wanted and needed by manufacturers, will not long go a-begging for customers.

Fireproof Construction.

A superficial inspection of the ruins left by the recent great conflagration in Clerkenwell, London, afforded much instruction as to the behavior of different kinds of building materials in resisting the action of a fierce fire. The buildings destroyed upon this occasion were mostly filled with wares of a highly inflammable character—such as toys, furs, clothing, paper, etc. In some places where the fire raged fiercest, and whence it extended in all directions, as from a center, everything had disappeared from the site except a heap of crumbling bricks—not even the mortar remained. Some brick walls continued standing near these places; but they were split and shaken from top to bottom. Further off were brick party walls, standing firmly enough themselves, but inclosing areas open from basement to sky, and destitute of front and back walls. Beyond these came the shells of houses, from which all the interior had been burnt out. It appeared from this scene that there is in conflagrations a point of intensity at which the best brickwork fails, although this is a point far beyond the durability of stone, concrete, or ironwork structures. Fireproof construction is, in fact, a term which can only be used in a comparative sense. At the same time, there are degrees in the capacity of materials to resist fire which do not always appear from a cursory appreciation of the nature of the material. Thus, among the ruins at Clerkenwell, there were many specimens of timber brest-summers which had failed and fallen rather from the yielding of their supports than from their own ignition. Provided that it is in sufficiently solid pieces, and shielded from air currents, timber is, for all structural purposes, more reliable in a fire than either stone or iron. Wrought iron girders fail at a comparatively early stage; and it is a question whether, for the support of shop and warehouse fronts, etc., solid timber posts, properly shielded, would not be preferable to iron or stone.—*Journal of Gas Lighting.*

IN a case of alleged epithelioma involving the facial bones, with extensive infiltration of the tissues, where an operation was not deemed desirable, Dr. Antonio, of Mazzara del Vallo Maggio, applied an ointment consisting of 15 parts of resorcine to 20 parts of vaseline twice a day, with the result, it is said, of completely curing the disease; nothing remaining but a white scar a centimeter in diameter.—*British Medical Journal.*

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Honors to Professor Hughes.—An Interesting Speech by Him.

The anniversary meeting of the Royal Society was held at their rooms, Burlington House, on the 30th of November. Students of electricity will welcome the announcement that a royal medal was awarded to Professor D. E. Hughes, F.R.S. At the anniversary dinner, the president, Professor Stokes, mentioned the presentation of the royal medal to Professor Hughes, and proposed a toast to the recipient, to which Professor Hughes replied as follows:

Mr. President, my Lords, and Gentlemen: I cannot hope to find suitable words to express my thanks for the kind manner in which you have responded to the toast proposed by our president, Professor Stokes, nor sufficiently thank him for the flattering terms in which he has mentioned my researches. The numerous experiments which led me to the invention of the microphone are based upon the discovery I made of the remarkable property of loose electrical contacts. If we make a bad joint or loose contact in an electric conductor, we find that not only do these disjointed conductors vibrate in unison with the atmosphere, but in vibrating they produce an enormous variation in the strength of the electrical current. And if we join a telephone in circuit, we find that every word spoken to the loose contact is repeated with absolute perfection. An equally remarkable fact is the reversibility of the effect, so that a loose electric contact will repeat in sound any variation of current passing through it; consequently, we may speak to one loose contact and listen to a second, when every word spoken to the first will be clearly heard. The greatest power of sound, however, is obtained when used with a telephone, and the augmentation of sound is greatest when the original sound is most feeble. In order to study the effects of feeble sounds, I at first listened to the ticking of a watch; and after making the microphone more sensitive, I was desirous of listening to sounds below the power of the human ear, such as those produced by the walking of a fly. This succeeded perfectly, but, unfortunately, flies were scarce at the time I was experimenting. I then studied sounds still more feeble, such as the sounds produced in a copper wire at each passage of an electric current —sounds which no human ear has heard direct, but which, by the aid of the microphone, are heard as a clear, ringing sound, due, I believe, to molecular motion in the wire itself. The microphone not only augments feeble sounds, but it will transmit the most complicated sounds of speech and music with absolute perfection. It has also been employed in physical, medical, and mechanical researches, and in France it has been of service to humanity in listening through the rocks to the sounds made by entombed miners, and by its indications encouraged the aid which finally saved them. The molecular sounds which the microphone revealed led me to invent an instrument which should penetrate inside of a metallic body, and reveal any change in its structure. This I accomplished in my induction balance. In this instrument induced currents from two separate coils are opposed and balanced with each other; but this balance of current is so sensitive that the slightest disturbance or reaction produced by the introduction of a piece of metal in one of the coils destroys the equilibrium. The amount of disturbance can be measured and the balance restored by the introduction into the second coil of a similar piece of metal or by an equal reaction. If we could find two equal pieces of metal, such as coins, they would balance each other; but in practice the instrument is so sensitive that it points out differences in two similar coins fresh from the mint, or in two pieces of equal weight cut off the same bar, due either to a slight chemical or molecular difference in the structure of the metal. Any physical or mechanical change, such as that produced by heat, magnetism, or strains, is at once declared; and it is particularly sensitive to such changes in iron or steel. A curious example of its sensitiveness to iron occurred at the Paris Electrical Exhibition. Elisha Gray, the inventor of the harmonic telegraph, told me that fifteen years ago a small iron filing had penetrated his finger, giving at first some pain, but the filing and pain soon disappeared. He was anxious to know if the filing was still in his finger. I told him to place each finger successively in the induction balance, which he did, and all fingers gave perfect silence except one. This finger, however, immediately acted on the balance, producing loud sounds, and this finger proved to be the one which had been injured by the filing. So there could be no doubt that the filing still remained after a period of fifteen years. If we place an iron bar or rod in the coils of the balance, we find that no two portions of the bar are exactly the same, and the slightest flaw, strain, or crystallization of the iron is at once detected. Now, if we could apply this method to locomotive axles, we should be able to detect, in advance, any defect, and thus prevent the numerous accidents which occur on our railways from this cause. At present we cannot do this without first detaching the axle from the locomotive, but I hope some day of finding a modification of the balance which will overcome this difficulty. The electric sonometer aids the induction balance by comparing sounds from an absolute zero to any desirable extent, and it has been found most useful for measuring the power of hearing in those partially deaf. To cite a single example: Dr. Richardson, F.R.S., lately published an account of a youth who had been very deaf for many years. On being observed by the aid of the sonometer, the sonometer indicated that the cause of deafness was that of a solid obstruction, and upon operation a stone or pebble, was found in the ear, which had been there unsuspected since childhood. On the removal of the pebble, the hearing was immediately and permanently restored. I will not detain you by speaking of my researches in electricity and magnetism, nor of the many remarkable effects of the microphone and induction balance, but I am proud to say that all these instruments and researches were first presented to the world through the *Proceedings of the Royal Society*. I am deeply grateful to Dr. De la Rue for having on many occasions assisted me with his valuable advice, and allowing me to make use of his magnificent laboratory whenever the nature of my experiments needed such aid. Allow me to express my sincere thanks for the great honor conferred on me this day, and for the kind manner with which you have listened to my remarks.

[How to Construct a Microphone will be found fully illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 163. How to Make the Induction Balance, in SUPPLEMENT, No. 196.]

Conditions of Success in Life.

In a recent address before the Georgia State Medical Association, Dr. Searcy stated that the physiological conditions of success in life depend mainly upon a vigorous, healthy action of the brain and nervous system. It follows, therefore, that the structural integrity and functional capacity of the brain are matters of the deepest importance, and their preservation and improvement are of vital moment. The author believes that much would be accomplished, could we discover the ways in which the brain capacity is increased and lowered. The problem is a most delicate one, for up to a certain point the receptivity of the brain is directly proportional to the strain already brought to bear upon its capacities. An even balance between the brain functions is an essential element. The superior man must have the ability, not only to comprehend, but, in an equal degree, to discriminate; he must be able to select for a purpose. Besides the ability to learn, a man, to be successful, needs the power to verify his learning, to deduce his own conclusions, and to execute his purposes with persistence.

A simply erudite man is not necessarily successful. On the contrary, he is often the reverse, a perfect failure, for lack of the saving virtue of common sense. The capacity to receive is of small value unless it be coupled with an ability to adjust, arrange, and impart. It frequently happens that a man who is simply a scholar and nothing else is at an absolute disadvantage in the presence of an unlettered man who is blessed with an inherent excellence of capacity in the three departments of brain action. One need not be educated to possess this trait, though it is the addition of education to such natural gifts that brings distinction. It is not an exaggeration to say that many a man of eminence has had occasion to envy his humbler associates the possession of those so-called commoner merits which would have given his own attainments a greater availability. Nature apparently requires a certain amount of the concrete to maintain a mental equipoise. The man who can learn, reason, and execute with equal facility possesses the elements of success, even though his qualities be of but an inferior order; while one who has any of these faculties abnormally developed at the expense of the others will always be crippled by the absence of the essential features of a successful life.

Telephoning from Lightships.

An experiment of the greatest importance to the commercial world is now being made on the east coast of England by the Telegraph Construction and Maintenance Company. For the last eight months the company has had several of its best operatives located in the neighborhood of the Naze, off which the most dangerous sands round England are to be found. These gentlemen are hourly in communication by telephone with a lightship which is anchored ten miles out, in the vicinity of the Swin passage. An ordinary telegraph cable has been laid from Walton-on-the-Naze to the Sunk Lightship, and telephone and telegraphic apparatus have been affixed to both ends.

It was considered improbable that the human voice would be conducted ten miles, especially in rough weather; but this has been now proved to be thoroughly practicable. A conversation was carried on with Mr. Stevenson, one of the Telegraph Maintenance Company's officials (who was on board the Sunk Lightship), by telephone, for a considerable time. Mr. Stevenson had been a month upon the boat, and had experienced all kinds of weather, during which time he had kept Mr. Lewis and Mr. Pinkerton, his colleagues on shore, fully informed of the state of the weather, roughness of the sea, and passing craft, adding frequently forecasts of weather, which usually turned out to be correct.

A month upon the lightship is a trying ordeal; but Mr. Stevenson was so satisfied with the success that attended the experiment, and knowing, if the advantage of telephonic communication with lightships was understood and generally adopted, what a splendid boon it would be to mariners and merchants, that he spent his time busily in collecting information, and watching the working of his electrical machines. In a back room of the Walton post office are machines for utilizing magnetic currents of all descriptions. A button is touched which rings a bell in Mr. Stevenson's cabin upon the Sunk Lightship, ten miles away; then a voice, that of Mr. Stevenson, is heard inquiring what is wanted. "How is the wind?" "How is the tide?" "Have you seen such and such a ship pass?" "How much water is there in the Swin passage?" These questions can be answered at once. Or the following is transmitted: "Signal such and such a ship that she is to put in at Harwich."

Every ship passing is duly signaled, and her name and description telephoned to the Walton post office. On an average, ninety ships pass in the day, and if it was known that messages could be sent ashore, no doubt the majority of these would avail themselves of the benefit. A considerable number of the ships passing have come great distances without passing one of Lloyd's signaling stations. The signaling of these passing the Sunk Lightship would be of great commercial value, as their time of arrival at any port they were bound for could be timed by the owners in London accurately, and everything could be made ready for the landing and the sale of the cargo.

Of much more importance is the use the telephone could be put to in a storm, or in the case of a ship getting on the sands. One night last year, in a rough sea, a ship did get on a sand bank, and instantly her exact position was telephoned to Walton from the lightship. The gentlemen at Walton awoke the lifeboat crew and telegraphed to Ramsgate and Harwich, where the lifeboats were got ready for launching. Just as all three lifeboats were about to start, a telephone message came from the lightship that the ship in distress had got safely off the sand bank, and that there was no need for the lifeboats to start. The boats were stopped, and if it had not been for the telephone they would have been out on the rough sea all night searching for the ship that sent up distress signals. If all the lightships around the coasts of Europe had this means of communication to point out the exact position of a ship in distress, a great number of lives would be saved, as the position of many ships foundering cannot be indicated with any certainty by the ordinary rocket signals. Besides the above uses of the telephone with lightships, all passing ships in quest of a pilot to navigate them through dangerous channels could without difficulty telephone their desires to shore.

The Sunk Lightship is only 150 tons, and yet only once in the stormiest sea, when she had been tossed about in a gale of wind, has the telegraph wire been broken. The two ends at the break were picked up and rejoined within twenty-four hours. She is moored in ten fathoms of water, and is manned by a captain and six to eight men, all of whom express their most earnest approval of the intercommunication with the shore, whereby they can make known, at once, their own and the wants of others. During the night, communication is as open as in the day. The Trinity Board is showing considerable interest in the experiment, and it is hoped that it will see the great importance of at once putting, by this means, the chief lightships in communication with the shore. It is stated by the gentlemen engaged at Walton that the telephone will act over twice ten miles; and there is no reason why some day it should not act over much greater distances.—*London Times.*

Manufacture of Writing Materials.

At a meeting of the Academie des Sciences, M. De Boutarel read an essay upon "Paper and the Industries connected with it," in the course of which he quoted some statistics as to the rapid increase in the quantity of pens, paper, pencils, etc., which are manufactured in Europe and the United States alone. M. De Boutarel says that the manufacture of paper, which at the beginning of the century was practically *nil* in the United States, now amounts to 500,000 tons per annum, and that it is just double this figure in Europe; the value of the straw, rags, and other materials used in the manufacture of the paper being £20,000,000. M. De Boutarel estimates the value of these 1,500,000 tons of paper, when manufactured, at £40,000,000; the note paper being calculated at 120,000 tons, worth £6,400,000. M. De Boutarel estimates the value of the steel pens manufactured annually at £800,000; while the number of heliotype plates may be safely estimated at 3,000,000 —thirty Paris houses alone turning out 900,000.

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Correspondence.

Fire from Steam Pipes.

To the Editor of the Scientific American:

On page 17 of the SCIENTIFIC AMERICAN, dated January 9th, 1886, is an article on the subject of fires caused by steam pipes. Will you please explain, through the medium of your valued paper, what it is that prevents the wooden lagging of locomotive boilers from firing? If the article is correct, a very few hours' exposure to the heat, due to the high steam pressure usually carried on these boilers (120 to 140 pounds per square inch), should cause it to char and ignite; while the fact remains that the wood stands for years, and, under normal conditions, never chars nor ignites. In fact, there are only two causes which can make it ignite: First, the sheet iron jacket sometimes gets loosened, and allows sparks from the smoke stack to get under and set fire to it. Second, if the water in the boiler gets low and the crown sheet becomes exposed, thus superheating the steam, the wood may char or possibly ignite. I have known sawdust and shavings to lie on top of a boiler for years, and never knew them to char or burn—the boiler meantime working at from 60 to 100 pounds pressure. In fact, you will find it impossible to set wood on fire with steam pipes working at any reasonable pressure, unless you use superheated steam.

E. P. CLARK.

Owego, Tioga County, N. Y., January 12, 1886.

A Case of Spontaneous Combustion.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN recently a good deal has been said about spontaneous combustion, and wood being first charred and then ignited by close contact with steam pipes. Permit me to state what occurred in my presence, some twenty years ago.

I was running a stationary engine of 25 horse power, steam being supplied from two cylinder boilers 28 feet long, through a copper pipe about 9 feet long. The engine was one of the old type, without piston springs; the rings being kept out by hemp packing being driven tight in between the piston head or spider and the packing rings. This packing required to be renewed frequently, perhaps once a month.

One day in the forenoon, the engine was working badly, the packing having got too loose. I told the fireman to let the steam go down at dinner hour, and while the hands were eating, I would pack the piston. When the whistle blew, I at once took off the cylinder head. I then unscrewed the bolts in the piston head (this was pretty hot work, as I hadn't given the piston time to cool, and there was a little damp steam leaking through the valves into the cylinder). As soon as I got the screws out, I pulled off the piston head. Immediately the air struck the old packing, it commenced burning, and in a minute or so it was all a mass of red fire.

The highest pressure of steam at any time on the boilers was 60 pounds, but the usual working pressure was 50 pounds to the inch.

When a fiber of hemp exposed to a pressure of only 50 pounds, for not over four weeks, of *wet steam* ignites as suddenly as this did, on getting access to the atmosphere, I think it can be safely concluded that many of our fires unaccounted for had their origin from close contiguity of *dry* steam pipes and wood.

If there is anything of value in this fact, you are at liberty to use it as you deem best for public safety.

J. R. MABERS.

Lynchburg, Va., Jan. 16, 1886.

The Natural Dissemination of Gold.

BY PATTERSON DU BOIS.

It is now nearly a quarter of a century since the people of Philadelphia were startled by the report that the bricks of their houses, as well as the clay beneath their streets, contained an appreciable proportion of gold. The revelation emanated from the Assay Office of the Mint; and the same authority that announced to every landowner his proprietorship in the treasure trove denied to him the means of extracting the wealth which nature, with such even-handed justice, had distributed through her wide domain.

In June, 1861, the then assistant assayer, Mr. William E. Du Bois, read before the American Philosophical Society a paper "On the Natural Dissemination of Gold," briefly setting forth the results of a series of investigations conducted by Mr. Jacob R. Eckfeldt, the assayer of the mint. These formed the basis of some curious propositions and calculations, which the author so interestingly presented as to lead to the republication of the pamphlet in England, as well as to countless abstracts by the daily press of our own country. Since then, there have been tidal waves of inquiry, and piecemeal expositions of the subject, the newspapers far and wide catching it up, copying and recopying from one another, diminishing truth and multiplying error, until it would seem that the time has now arrived for a fresh start in an authorized republication. While not strictly *apropos* of numismatics, there are reasons why this account of a treasure trove may not be altogether out of place, and certainly not void of interest to the readers of the *American Journal of Numismatics*. I therefore reprint the main portion of the original report, as follows:

"To assert that gold is at once a very rare and a very abundant metal would seem to be an abuse of language; and yet, in a certain sense, it would be true in both branches of the proposition. Iron, in its many mineralized forms, has been profusely scattered by the Creative Hand all over the world; and gold is found in so many natural situations and alliances where it would not be looked for, as to hold out the expectation that a diligent search would find it almost as widely, though by no means so plentifully, diffused. Such is not the fact in regard to many other metals, but it is remarkably true of the two which stand in the market at the head and foot of the list.

"These remarks are preliminary to the detail of several interesting examinations lately made by Mr. Eckfeldt, the principal assayer of the mint, from time to time, as opportunities of leisure would allow.

"The first experiments were made upon galena, or native sulphide of lead. It was well known that this was occasionally found to contain gold in larger or smaller proportions, according to the various localities. But inasmuch as there is reason to believe that every variety of galena is argentiferous, it seemed an interesting inquiry whether *gold*, as well as silver, is sure to be found in the same association. Our examinations have gone far enough to warrant the belief that such is the case. . . .

"We find in the galena of Ulster County, New York (Ellenville locality), gold to the amount of 17½ grains, or 75 cents, to the ton.

"The most curious result was obtained from the galena of New Britain, in Bucks County, Pennsylvania, where gold was found in the proportion of 2¼ grains, not quite ten cents, to the ton. This represents one part in 6,220,000, and may serve as a remarkable example of refinement in the art of assaying. The operation was performed on five ounces of the ore. The speck of gold which resulted is visible to a good eye, and is exhibited in the cabinet of the mint.

"Turning next to the examination of lead in its metallic and commercial shape, we find the Spanish bar lead, which is sufficiently free from precious metals to be used as an agent in our mint assays, contains 12 grains of gold to the ton, or one part in about 1,170,000.

"The next inquiry was, whether other metals, especially those which are commonly considered to be naturally unaccompanied with gold, were absolutely so.

"Copper was tried in various forms. A cent of 1822, the material for which was imported from England, showed gold equal to one part in 14,500, which is one cent's worth in twenty cents. An English halfpenny showed a like trace of gold. A cent of 1843, of American material, was found to contain one cent's worth of gold in fourteen cents. The result brings to mind the old story of the golden cent of 1814. In that year, as was idly reported, the melters at the mint carelessly emptied some gold into a pot of copper from which the cents were coined. It gave some trouble at the counter of the mint for many years afterward, in consequence of numerous inquiries and offers to sell. It turns out to be pretty certain that every cent we have coined contains gold, effectually locked in.

"Lake Superior copper is perhaps as free from gold as any, yet is not absolutely so. A trial of 30 grammes showed a quantity not sufficient to affect sensibly a delicate assay balance.

"Adverting to other metals, it is well known that silver is never found in nature quite free from gold.

. . . . . .

"A specimen of metallic antimony was found to contain gold, one part in 440,000. In bismuth the gold amounted to one part in 400,000. A specimen of zinc proved to be absolutely free from gold, a result which may relieve some minds of the suspicion that the very atmosphere of the mint imparts gold to everything within its walls, or that there was a want of the utmost care in the use of vessels and reagents in these operations.

"Perhaps the most curious result of all is that which remains to be stated.

"Underneath the paved city of Philadelphia there lies a deposit of clay, whose area, by a probable estimate, would measure over three miles square, enabling us to figure out the convenient sum of ten square miles.* The average depth is believed to be not less than fifteen feet. The inquiry was started whether gold was diffused in this earthy bed. From a central locality, which might afford a fair assay for the whole, the cellar of the new market house in Market Street, near Eleventh Street, we dug out some of the clay, at a depth of fourteen feet, where it could not have been an artificial deposit. The weight of 130 grammes was dried and duly treated, and yielded one-eighth of a milligramme of gold, a very decided quantity on a fine assay balance.

"It was afterward ascertained that the clay in its natural moisture loses about fifteen per cent by drying. So that, as it lies in the ground, the clay contains one part gold in 1,224,000.

"This experiment was repeated upon clay taken from a brickyard in the suburbs of the city, with nearly the same result.

"In order to calculate with some accuracy the value of this body of wealth, we cut out blocks of the clay, and found that on an average a cubic foot, as it lies in the ground, weighs 120 pounds, as near as may be, making the specific gravity 1·92. The assay gives seven-tenths of a grain, say three cents' worth of gold to the cubic foot. Assuming the data already given, we get 4,180 millions of cubic feet of clay under our streets and houses, in which securely lies 126 millions of dollars. And if, as is pretty certain, the corporate limits of the city would afford eight times this bulk of clay, we have more gold than has yet been brought, according to the statistics, from California and Australia.

"It is also apparent that every time a cart load of clay is hauled out of a cellar enough gold goes with it to pay for the carting. And if the bricks which front our houses could have brought to their surface in the form of gold leaf the amount of gold which they contain, we should have the glittering show of two square inches on every brick.

"We have inquired but little into the researches of other experimenters in this line. Some years ago it was stated that Mr. Lennig's workmen had washed out gold from the sands of the River Delaware, and a French writer affirms that there is a trace of gold in the sands of the Rhine.

"When we consider the uses to which this noble metal is providentially adapted and wisely applied, we cannot but wonder at the apparent waste or misplacement by which so much is irrecoverably lost, and to all appearance had as well not been made. Perhaps such inscrutable mysteries in the realm of nature may help us to submit to other difficulties in other parts of the divine order and government. Of this we may be confident—that the atoms of gold are homogeneously and equally disposed through the clay or other matrix; but by what natural process, and for what final cause, these fine particles should be thus diffused, seems quite beyond the reach of human philosophy.

"The paper thus offered, however deficient and practically unimportant, may afford a diversion of mind, for the moment, from the one idea of the times upon which we have fallen."

In one sense the facts and figures may be regarded, at least by the unscientific, as "practically unimportant." But after all, there is another practicality, of the moral sort, suggested by the author's concluding reflections. If these "inscrutable mysteries in the realm of nature" *do* help us to "submit to other difficulties," their end is quite practical; and the marvelous attenuation that deprives the gold of all its value to the political economist accords it a new and higher value in the better economy of the moral and spiritual life of man.

It remains only to add, that all the subsequent experience of these two assayers, as well as of those who succeed them, confirms these remarkable conclusions upon the natural dissemination of gold.

* It must be borne in mind that these figures apply to the Philadelphia of twenty-five years ago. It is hardly necessary to remind the reader that they would be much amplified now.—P. Du B.

The Waring Anti-induction Cable.

The Waring anti-induction cables are manufactured in many forms to suit a variety of uses, and may contain any required number of conductors; but whatever the form, the general principle of construction is substantially the same in all. The conductor is first enveloped in a wrapping of fibrous or textile material, which is then saturated and coated with an insulating compound, to which the name "ozite" has been given, and the whole is afterward inclosed in a continuous sheathing of lead, which is pressed closely around the insulated conductors, each conductor being separately surrounded by the metal on all sides. This metallic sheath serves to perfectly screen each conductor from all induced currents from adjacent parallel conductors, making it the only absolutely anti-induction cable, and the only cable in which telegraph, telephone, and electric light circuits may be worked side by side without interfering the one with the other. The disastrous effect of induction on telephone circuits is so well known that no elaboration is needed. In the Waring anti-induction cable the inductive action from wire to wire is, of course, effectually cut off by the intervening shield of metal, a feature which renders the cable peculiarly well adapted for the telephone service. But not only does the construction of this cable prevent interference from induction in the cable conductors themselves, but also where air lines are connected to even a short length of the cable the latter is found to eliminate induction.

No underground cable that does not embody this anti-induction feature is adapted for a general underground system, in which telegraph, telephone, and other electric circuits may be worked in the same cable.

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THE NEW YORK CABLE RAILWAY.

(*Continued from first page.*)

in a few inches of each other. One of these sections now operates the line along 10th Avenue, and the other will in the near future operate cables passing through 125th Street, from river to river. On the main shaft are four loosely mounted pinions, two at each section. Each pinion drives a train of gearing carrying a pair of drums, and as they are precisely alike in construction, a description of one will answer for all. Meshing with the pinion is a gear on a shaft, so mounted that it carries one of the driving drums upon its outer end. The second driving drum is carried by a shaft having a large gear wheel, similar to the one on the first shaft. Between and meshing with these gears is a smaller one. Around each pair of drums a cable is wound.

An important variation from the construction usually found in machinery of this kind is here introduced. Generally the bearings of the drum shaft are placed one at each side of the drum. The advantage of placing both bearings at the same side of the drum, as in this case, is apparent. When the tension car, owing to the stretching of the rope, has reached the upper or farther end of the pit, the surplus length of rope can be easily taken up by winding it once more around the driving drums, thereby saving the time, trouble, and expense of splicing. The outer ends of each pair of drum shafts are connected by a strut, adjustable in length by a key, and which serves to take the strain created by the cable passing around the drums, and relieves the bearings.

Each pinion on the line shaft is provided with a friction clutch operated by a handle lever, the bearing points of which are so arranged that there is no strain brought upon the shaft, to throw it either way in the direction of its axis, when the clutch is closed. The clutch consists of two sets of steel plates, one set secured to the pinion and the other to a sleeve sliding longitudinally upon, but revolving with, the shaft. The plates of one set alternate between those of the other, so that when pressed together by the lever, operating through a compound toggle, the friction between them is sufficient to revolve the pinion with the shaft.

The incoming portion of the cable passes around the drums, then around a sheave on a car running on tracks laid on the edges of the pit, shown in Fig. 1, and then to a sheave located so as to guide the rope into the trench along the middle of the street, as shown in Fig. 2. The slack in the cable is taken up by weights on a differential lever at the upper or rear end of the tension pit. The two cables operated by the same section run through the trench upon independent pulleys at a distance of about 3 inches apart. The grip is formed with clutching jaws at each side of the lower end, so that either cable may be grasped to propel the car. By means of the double grip, the cable in use is bound to drop into the grooves of its own pulleys as the car passes on. A cross section of the trench is shown in Fig. 2.

The care of the ropes in the cable system is a very important item, and experience has proved that they should be examined at least once in twenty-four hours, to discover, if possible, any breaks which might otherwise cause the rope to "strand." For this purpose the pair of small vertical engines shown in the center of each section are provided to move the idle rope slowly. It is also very convenient often in repairing a rope to move it a very little, without starting the main engines. Steam is supplied by four return tubular boilers of 150 horse power each, located in the rear of the engine room. The operating machinery was built by Messrs. Poole & Hunt, of Baltimore, Md. Its smooth and almost noiseless working shows the accuracy and skill displayed in executing the designs, while the great size of many of the parts shows the facilities at their command, and conveys some idea of the extent of their works. The duplicate system for cable railways is the invention of Mr. D. J. Miller, of this city.

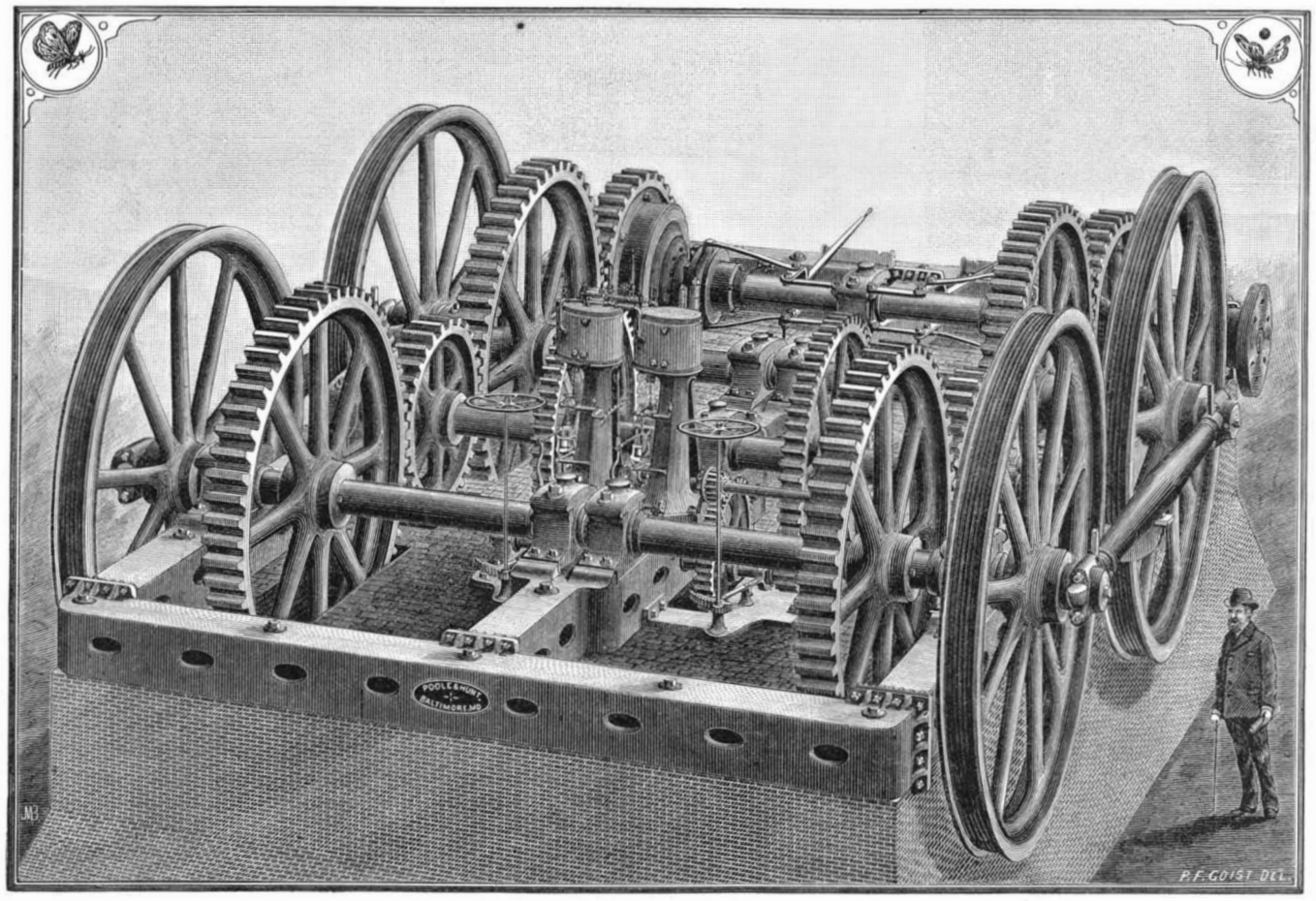
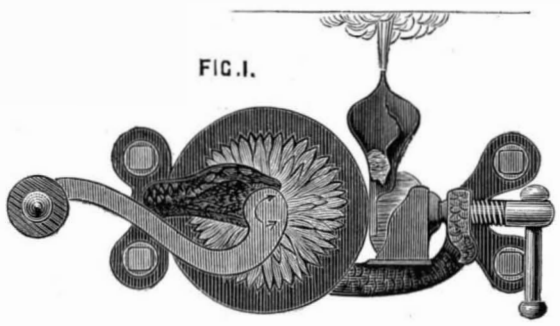


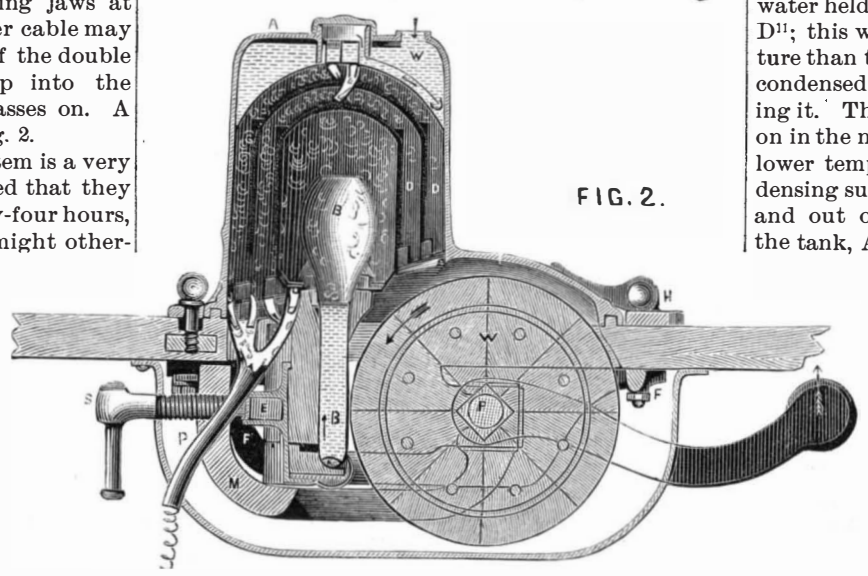
Fig. 3.—NEW YORK CITY CABLE RAILWAY.—ENLARGED VIEW OF ONE SECTION.

MAKING STEAM BY FRICTION.

The friction still illustrated by the accompanying engravings has been devised, says the *Engineer*, by Mr. Lional Pearse, of Coalbournbrook, near Stourbridge, for the production in an open boat, or in any boat at sea, of small quantities of fresh water from sea water without any heat supply except that of muscular energy. The still and the small machine for illustrating the frictional generation of heat are very ingenious applications of well known phenomena and of the experiments of Count Rumford. Mr. Pearse has succeeded in solving a problem which has occupied many minds; and although no vessel expects to be wrecked, there is little doubt every well-appointed passenger ship will carry several of these little machines for their boats.

Fig. 2 shows a friction still fixed to and let through the seat or after thwart of a ship's boat; above that seat is the condensing or domed part, and below is the malleable iron framing. The machine may, of course, be fixed to any, or the most convenient, place in a boat. Our engraving is about one-fourth full size. The framing may be said to consist of two parts, one fixed and the other movable; the fixed frame, F, being bolted through the seat, fixes the part above the seat to that below. The metal supporting the boiler must be understood to be part of this fixed frame, though the section does not clearly show it. The movable frame, M, is capable of a sliding motion in three bearings, one above the pressure screw, S, and another to each side of friction wheel, W. It is single where shown in section, and branches off to each side of the wheel to form bearings for the spindle, P. This frame brings the friction wheel, W, in contact with the boiler, B, at B^1 with any desired pressure, regulated by the pressure screw, S. The inequalities which may occur in the periphery of the friction wheel are compensated for in the elasticity of the packing at E. Either side of the spindle may be fitted with a handle, and the same still can be worked effectively within the range of power from that of a lad of fourteen years of age to 4 man power. The boiler, B, is held in a hard wood block to prevent heat being readily conducted to the metal frame supporting it. The upper part of the machine is hinged at H, and may be thrown open, leaving boiler and friction wheel exposed; the inner domes, D^1 D^{11}, also hinge open or take out for any attention that may be required.





MAKING STEAM BY FRICTION.

The overflow tank, T, is pivoted so as to be easily released from the boiler. The manner in which it is fed and the action are as follows: It will be seen that the upper tank, A, is full of sea water; from this tank the water is made to pass at intervals in the directions indicated by the arrows. It then passes down small pipes shown in the center, and feeds or saturates the flannel with which the two domes are covered. The arrows still indicate the course of the sea water after it has left the coverings, and it will be seen that that from the inner dome, D^{11}, as it is collected by its trough, runs through a pipe into the overflow tank, T, which tank is openly connected with boiler, B, keeping that fed with sea water to the height allowed by overflow tank; the overflow from the middle dome, D^1, is allowed so run away as cooling water, because that from the inner dome is sufficient feed for the boiler, and, being hotter than that from D^1, is preferred. The water enters the boiler at the bottom, as shown by the arrow. The heat result of the friction of the wooden wheel, W, against the steel on the boiler at B^1 causes the sea water to boil in about half a minute. The steam then rising is wrapped in the dome, D^{11}, and, condensing upon its inner surface, drains away into its trough, then from that to outlet pipe, P. The condensed steam or distilled water may be traced throughout the engraving indicated as drops.

The heat given up by the steam condensed upon the inner surface of dome, D^{11}, will be imparted to the sea water held in the saturated flannel covering the dome, D^{11}; this water is freely vaporized at a lower temperature than that required for the boiler, its vapor being condensed upon the inner surface of dome, D^1, inclosing it. The action of vaporizing and condensing goes on in the next compartment, as just described, but at a lower temperature; the product from the three condensing surfaces can be traced as drops all flowing into and out of outlet pipe, P. The feed water, W, in the tank, A, will, when the machine is in full work, reach a temperature that a delicate hand cannot bear by heat imparted to it from the vapor which condenses upon the domed bottom of the tank.

If the machine is worked by the power of a boy of fourteen years, the product from the two flannel-covered domes will be nearly double that of the boiler; if worked by a man, the product from the boiler will be equal that of the two domes, making the profit through the domes upon the man's work much less in proportion to that of the boy's work. Cov-

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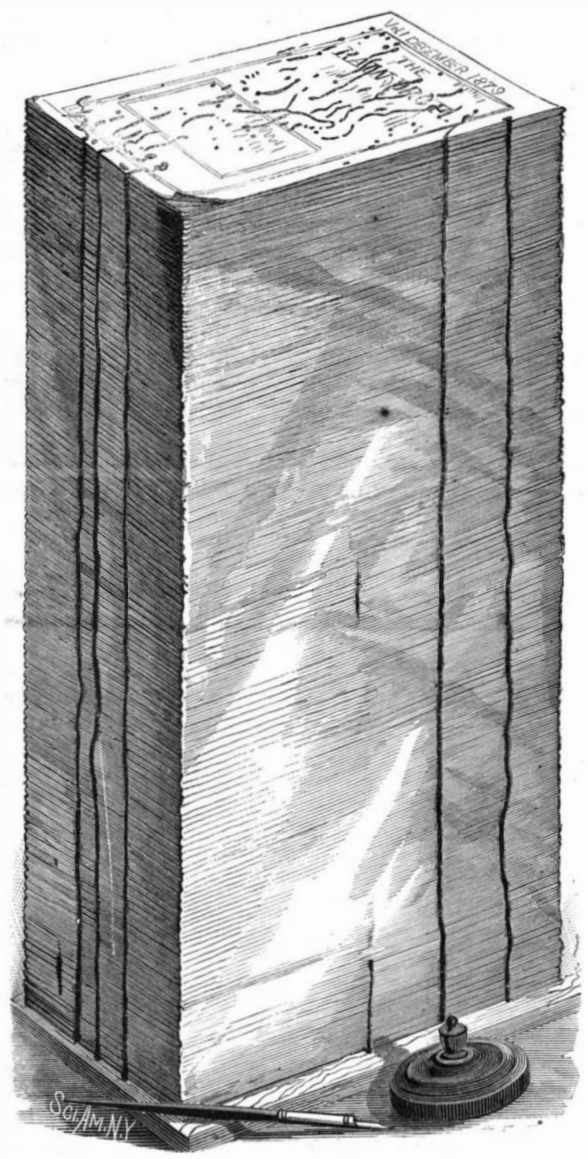
ered domes may be used with profit to any convenient number, but, on account of size, the inventor prefers to put only three in the friction still. In its present form the still is capable of producing thirty pints of distilled water in twenty-four hours, sufficient, he thinks, for any small boat's crew. Salt will not, we are informed, appear deposited if the machine is used properly, or unless all in the boiler or in the domes is vaporized to dryness.

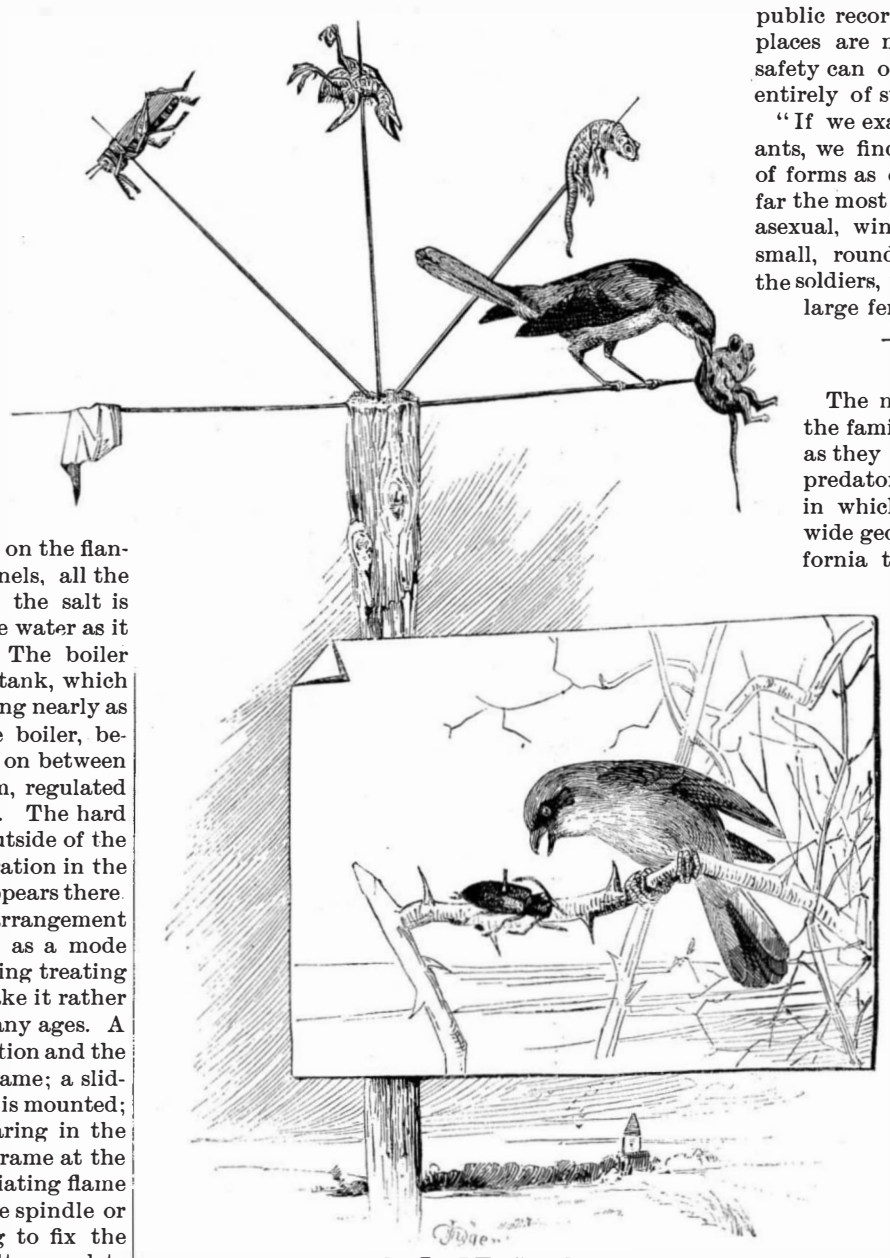
Should this occur—and it must occur many times before sufficient salt is incrusted to cause any serious loss of heat—it can be got at by throwing the top open and releasing the overflow tank. The domes are cleansed by allowing a quantity of water to flow over them when not at work. The inventor explains the non-appearance of salt in the boiler and on the flannels by saying that, in the case of the flannels, all the water fed to them is not vaporized; thus the salt is kept in solution, and is carried off in the water as it runs to waste or to the overflow tank. The boiler does not show any because of the overflow tank, which is always wasting water, and its water being nearly as heavily charged with salt as that of the boiler, because a certain amount of circulation goes on between them; so the salt is kept at an equilibrium, regulated by the salt carried away in the overflow. The hard salt that does appear is only found on the outside of the overflow tank, TT. So long as the evaporation in the boiler is not allowed to empty it, no salt appears there.

Fig. 1 of our engravings shows another arrangement by the same inventor for utilizing friction as a mode of heat. As this is not like the still—a thing treating of life and death—he has thought fit to make it rather fantastic, and his design carries us back many ages. A single casting, taking a snake-like configuration and the necessary course, forms the whole of the frame; a sliding box carries the wood in which the boiler is mounted; the spindle of friction wheel has one bearing in the mouth of the creature and another in the frame at the opposite side of the friction wheel; the radiating flame piece or wheel boss is in one piece with the spindle or is fixed thereto, the purpose of it being to fix the wooden wheel; an ordinary handle and bolts complete the machine, the boilers for which may have various sizes or shapes, according to purpose.

The inventor devised it as specially suitable for lectures on physics, for use in magazines where fire is not allowed, or for heating shaving water, where half a minute's vigorous work every morning serves the purpose of providing a little hot water for this purpose, waking the shaver up, and providing him with exercise which is better now than in July.



BOARD AND PAMPHLETS PERFORATED BY THE TERMES FLAVIPES.



FEATHERED BUTCHERS.

THE TERMES FLAVIPES.

We received some time ago, from Mr. Joseph Eichbaum, of Pittsburg, a pamphlet which had been curiously eaten away by a small boring insect. The pile containing the pamphlet stood on a half inch board, and was about three feet high. Both board and pamphlets had been completely penetrated as represented in our engraving. Mr. Eichbaum found a small white worm, to which he was inclined to attribute the injury. After examining the result of its work, however, Professor C. V. Riley, the Government Entomologist, decided that it was due to the activity of that mischievous pest of the libraries, the white ant. He describes it as follows:

"The pamphlet perforated with numerous round, or oval, or oblong holes, or even with long branching slits, admirably illustrates the work of one of the most dangerous insect enemies to libraries and stored paper. This is the notorious white ant (*Termes flavipes*), which has received its popular name from its external resemblance to our commoner ants, as well as from its somewhat similar mode of life, *i. e.*, congregating in large, well organized colonies. Otherwise, the white ants have no relation to the true ants, the former belonging to the order Neuroptera, the latter to the Hymenoptera. The colonies of *Termes flavipes*, the only species of white ant occurring in North America east of the Rocky Mountains, are to be found in the ground under large stones, or within old stumps or roots, but never exposed to the light. As the food of these insects consists of dry vegetable fiber, their work in the field proves beneficial by hastening the decay and crumbling of old logs, etc.; but, unfortunately, these insects also destroy fence posts and fence boards, enter our houses, and stealthily weaken the beams and rafters. But, above all, they prefer to attack rows of old leather bound books or piled up paper, working through covers and pages in the manner illustrated by the pamphlet sent by Mr. Eichbaum. As the white ants never come to the surface, but always work in the interior of woodwork or within books, the mischief done by them is usually not observed until the destruction is complete, and herein lies the great danger from these insects. Thus quite a number of instances are on record where in public or private libraries large rows of valuable books or documents were found to be utterly destroyed by the white ants before their presence was suspected.

"In the Southern States, and especially in tropical countries, the white ants are much more numerous and their inroads into houses more frequent than in the North, so that in some places it is only possible by incessant watchfulness to preserve and protect the public records. Books kept in rather damp and dark places are more exposed to this danger, but perfect safety can only be secured in buildings constructed entirely of stone and iron.

"If we examine the individuals of a colony of white ants, we find among them the same wonderful variety of forms as exhibited in honey bees or true ants. By far the most numerous class are the workers, which are asexual, wingless, yellowish white, the head being small, rounded, and the jaws very minute; then come the soldiers, with immense head and jaws, and then the large females."

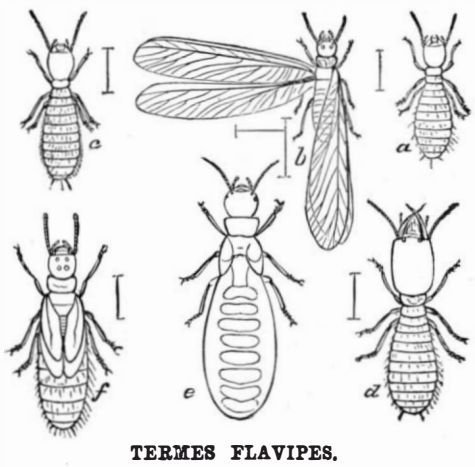
FEATHERED BUTCHERS.

The name butcher bird, that is often given to the family *Laniadæ*, or shrikes, is not misapplied, as they are quite equal to the hawks and other predatory birds in their courage and the cruelty in which they seem to delight. They have a wide geographical distribution. In southern California they are particularly common, and at the time of writing, Dec. 17, in Los Angeles County, they are to be seen upon almost any tree, where they sit motionless, awaiting the approach of their prey, which is of a most varied character.

The shrikes are powerful birds, of attractive mien, presenting an appearance indicative of courage. In many the upper mandible is arched and hooked, forming a powerful weapon with which to tear and lacerate their prey. The adults attain nearly the size of a robin.

It is, however, the habits of the bird that are the most interesting, and the term butcher is applied perhaps from the fact of their impaling their victims. In California they catch a large variety of lizards, including the horned toad, mice, and kangaroo rats, and one has been seen flying laboriously, carrying a blue jay quite as large, if not larger, than itself. As a rule, game thus captured is taken to some favorite spot and impaled or hung up, and then torn apart, so that in a locality frequented by these birds quite a museum is often found, composed of the dried remains of various animals, the dismembered parts, bits of bone, and other material. In southern California the orange tree offers every inducement to these butchers, the thorns with which the branches are armed being used for this singular purpose of laceration. Sitting perfectly immovable on a twig, the bird suddenly espies a horned toad or lizard, and darting down, before the frightened animal can bury itself or seek shelter, it is seized in the powerful beak and borne struggling to the place of execution. At first the victim is often held down with one claw, after the manner practiced by hawks, and so torn and lacerated; but generally a sharp thorn or a pointed twig is selected, and the body forced against it until it is firmly impaled. This having been accomplished successfully, the body is sometimes left, as often the capture is seemingly made in wanton pleasure, for the mere sake of killing; the victim left disemboweled—a grim warning to others.

When the butcher is disposed to devour its game, the thorn is used to help tear it apart, the flesh being



TERMES FLAVIPES.

a, larva; *b*, winged male; *c*, worker; *d*, soldier; *e*, large female; *f*, pupa. (After Riley.)

torn in both directions. So strong is this habit that in confinement the bird still takes advantage of any sharp object. Thus a pointed stick, sharpened for the purpose, being given a caged butcher bird, all its food, consisting of raw meat, was immediately placed upon it, and either left or devoured.

A neighbor of mine arranged a series of spikes in a star form, for the benefit of the birds that carried on their depredations in the vicinity, and found that they eagerly took advantage of the artificial thorns, a variety of animals being arranged upon the spikes. Not only were living creatures impaled, but various

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gaudy objects that might attract attention. My informant watched one bird for a long time, at work, attempting to disengage a piece of red flannel from a bush where it was entangled. It was eventually successful, and immediately the gay cloth was hung among the victims, a ghastly piece of humor, the red pennant waving in the breeze, seemingly intensifying the horrors of the butchery.

This bird, which was of extreme size, was seen attempting to carry off a young pouched gopher; but it was only able to bear it to the ground under the impaling machine, where, by discordant shrieks, it showed its rage and displeasure.

The butcher bird appears to entertain a particular hatred to caged birds, darting toward them with the greatest fury, and, if unable to reach them, flying about the cage, in some instances causing the death of delicate canaries from mere fright. In a case that came under my notice a butcher bird noticed a canary hanging inside a window, and darted at it with such force that the pane was shattered. The butcher must have been severely shaken up at least, but it kept fluttering about, endeavoring to reach the caged bird, and only left when driven away by the interposition of some of the family.

This occurred in Connecticut, but the birds here in their winter home exhibit the same hatred. In our neighborhood a pair of birds were hung out under a live oak, and on going to take them in, the owner found both birds lying on the bottom of the cage headless, these important members having been ruthlessly torn off, and one ornamenting the thorn of a neighboring orange tree. As the cage was neither broken nor bent, it was somewhat of a puzzle how the outrage was perpetrated, but later the same bird was seen darting at another caged canary that hung in a window. The butcher rushed at it, seizing the wire with one claw, and by beating the cage with its wings it completely demoralized the inmate, who finally, in its struggles, flew near the bold intruder, who quickly threw out one of its powerful claws and grasped viciously at its victim. Undoubtedly it would have torn the canary's head off in this way had it not been disturbed.

The butcher birds are not at all particular as to their food, it varying from blue jays and gophers to grasshoppers, even worms, scorpions, and centipedes being found impaled on the same or neighboring trees.

Although these birds are cruel and vindictive, they are bold and courageous in any contingency, attacking the largest hawk or eagle in the defense of their young. The peculiar bravery of the little king bird, a member of this family, is well known. I have often seen them combine against a hawk and utterly rout him. Crows seem to be especially disagreeable to them, and one king bird is quite sufficient to dispossess an ordinary crow. Wilson says, in referring to the American butcher bird: "The character of the butcher bird is entitled to no common degree of respect. His activity is visible in all his motions, his courage and intrepidity beyond every other bird of his size (one of his own tribe only excepted, *L. tyrannus*, or king bird), and in his affection for his young he is surpassed by no other. He associates with them in the latter part of summer, the whole family hunting in company. He attacks the largest hawk or eagle in their defense with a resolution truly astonishing; so that all of them respect him, and on every occasion decline the contest. As the snows of winter approach, he descends from the mountainous forests and from the regions of the north to the more cultivated parts of the country, hovering about our hedgerows, orchards, and meadows, and disappears again early in April."

The common American form is the *Lanius borealis*, while the familiar English species are the great gray shrike (*L. excubitor*) and the red-backed shrike (*L. collurio*). The former is about the size of a thrush, with a powerful black beak, protected at its base by bristles. The upper portions of the plumage are pale blue ash, with white underneath. The wings and tail are black, also a band that crosses the eye, some white being on the scapulars and tail. Referring to this bird, an English writer says:

"It is common all the year in France, and is known in this country chiefly as a somewhat rare winter visitant. It is one of our late birds of passage, but its arrival is soon made known to us by its croaking, unmusical voice, from the summit of some tree. Its nest is large and ill concealed; and during the season of incubation the male bird is particularly vigilant, and uneasy at any approach toward his sitting mate, though often by his clamorous anxiety he betrays it. The female, when the eggs are hatched, unites her vociferations with those of the male, and facilitates the detection of the brood. Both birds are very assiduous in their attentions to their offspring, feeding them long after they have left the nest, for the young appear to be heavy, inactive birds, and little able to capture the winged insects that constitute their principal food. I could never discover that this bird destroyed others smaller than itself, or even fed upon flesh. I have hung up dead young birds, and even parts of them, near their nests, but never found that they were touched by the shrike. Yet it appears that it must be a butcher too, and that the name *Lanius*, bestowed on it by Gesner two hundred and fifty years ago, was not lightly given. My neighbor's gamekeeper kills it as a bird of prey, and tells me that he has known it to draw the weak young pheasants through the bars of the breeding coops; and others have assured me that they have killed them when banqueting on the carcass of some little bird they had captured. All small birds have an antipathy to the shrike, betray anger and utter the moan of danger when it approaches their nests. I have often heard this signal of distress, and, cautiously approaching to learn the cause, have frequently found that this butcher bird occasioned it. They will mob, attack, and drive it away, as they do the owl, as if fully acquainted with its plundering propensities."

The red-back shrike derives its name from the fact that the back, scapulars, and wing coverts are a rusty red hue. It arrives in England in May, breeds in the southern counties, and departs in September for France and the countries bordering the Mediterranean.

The butcher bird in southern California greatly resembles the English great gray shrike, and presents an attractive appearance when on the wing, the black, gray, and white markings affording a striking contrast. They are quite valuable from the fact that they destroy so many noxious insects.

How the Ocean Bottom is Lighted.

One of the most striking things noticeable in dredging is the great variety and brilliancy of colors in the deep sea animals. There are bright red sea anemones, deep purple sea pens, delicate pink corals, pure white sea cucumbers, and dull black fishes, all mixed up in a mass of bluish gray mud. A few of the animals are blind, but most of them have very well developed eyes. In depths of over 1,000 fathoms it is physically impossible for the faintest gleam of sunlight to penetrate. It must be darker on the ocean bottom in 2,000 fathoms than the darkest starless night, that is, if nothing but sunlight were to be depended upon. If it was as dark as that, neither eyes nor colors would be of any use. Nature does not support useless organs, and when an organ is no longer needed, it is dropped. The fish of Mammoth Cave, no longer needing eyes, have become blind. Such would be the case in the deep sea. Another proof that there is light on the ocean bottom is the fact that many unprotected animals assume the colors of larger animals on which they habitually live. There is a brittle star that is always found in the branches of a bright orange-bush coral, and unless looking at it very closely, one can hardly distinguish it. There is an object in this—the starfish wishes to conceal itself; but if the ocean bottom was totally dark, there would be no need of such an arrangement, for the darkness alone would be sufficient.

One evening the dredge came up at eleven o'clock, and the electric light suddenly went out while we were examining its contents. Just before it became dark, I had thrust my hand in the mud to draw out a rare shell; and when I withdrew my hand it glowed with phosphorescence, the mud was covered with a phosphorescent light, and many of the animals when touched gave out a brilliant glow. This was the secret of the deep sea eyes and colors. With such a light, both sight and color would be as useful at the bottom of the sea as on the surface.

I believe, if we could suddenly find ourselves on the ocean bottom, in 2,000 fathoms, we should see brilliant white lights, casting intense shadows, illuminating the ocean bottom in an effectual manner. There would be vast tracts of darkness almost absolute, and here the blind forms would habitually live, having no use for colors or light. Groves of coral would shine with this intense light, shrimp and fish would dart about, specter like, over an illuminated pathway, each carrying his own lamp, and the whole ground would be one glow of phosphorescent light.

On the surface many animals are phosphorescent; the large schools of mackerel and menhaden can be seen for miles emitting a bright light. In the evening, on the seashore, the surface is often aglow with silvery light. On such nights the sailors say, "A storm is coming." The billions of embryos and microscopic animals that fill the surface waters each emits a little firefly spark, and all vie with each other to see which can excel in brightness. The result is a sheet of pure white light. The boat leaves a train of bright light and silvery drops fall from the oar back into the water, sending a little spray of light into the air, and spreading out little ripples of phosphorescence. Why these tiny animals emit their little sparks is not known, though it is generally said that it is the result of nervous excitement or irritation. When sailing in the Gulf Stream, I have passed through schools of jelly fish, when the prow of the vessel turned up brilliant waves of living light, and the whole surface for miles around was aglow with phosphorescence. In this case the light is for protection. Animals that might be dangerous enemies to the soft bodied jelly fish have learned that behind that brilliant light lurk deadly stinging powers, and they instinctively avoid it. But young and inexperienced fish have not yet learned the lesson; and so, attracted by curiosity, they approach the light and receive the deadly shock, and furnish food to the well protected jelly fish. If one escapes, it never tries the experiment again, for just as certain as it comes near the jelly fish it receives a shock that, if not fatal, is strong enough to inspire it with terror that will never be forgotten. An inoffensive animal has learned the terror that the jelly fish inspires its enemies with, and has assumed the same protective light. This is Pyrosoma, the sea lamp, a cluster of ascidians that have no stinging power whatever, but which defraud fish that might be dangerous enemies into the belief that they are jelly fishes.

There was a time when the ocean bottom was much nearer the surface than at present, and when sunlight pervaded the entire water. Phosphorescence was then in use by a few animals just as it is to-day, for protective powers. Gradually the ocean bed sank and became darker, until the sunlight was no longer of use to the denizens of the deep. The few phosphorescent animals found another use for their light than protection. It became serviceable as a lamp to illuminate their dark home. Other animals saw the use of the light, and, just as in the case of Pyrosoma, began to adapt themselves to their surroundings by becoming phosphorescent. There is some strange law of evolution that allows this to be done. Animals and plants alike in their struggle for existence can assume colors and forms best adapted for survival. This is illustrated on every hand in the sea and on the land. What the power is that allows them to do this is unknown. Be it Providence, instinct, or unconscious change, the result is the same; it is done and is being done every day, nearly always to the advantage of the species.

RALPH S. TARR.

How an Astronomer Captured a Comet.

In the SCIENTIFIC AMERICAN of January 16 we gave a notice of the recent discovery of a new comet by Mr. W. R. Brooks, of Red House Observatory, Phelps, N. Y. The following extract from a private letter by Mr. Brooks to a friend, which we are permitted to make, gives an interesting account of some of the circumstances attending the discovery:

Mr. Brooks says: "When I discovered the new comet in the early evening of December 26, 1885, it was in the constellation Aquila, and already low down in the western heavens. It was fast settling down into the tops of the trees of my orchard, and for some time the limbs of the trees were visible in the field of the telescope along with the comet, greatly to my embarrassment. I had secured the approximate position of the comet, but had not obtained its direction of motion, which I was very anxious to do in order to telegraph the discovery that evening. But the comet soon disappeared behind the trees, and further observations were impossible that night from the observatory. So I removed the telescope from it spermanent stand, carried the instrument across the garden and around the house to the front yard, which faces the west. It was a heavy lift and a big armful, for the telescope tube is of iron, and a foot in diameter. I called to my wife and father to bring out a table, laid the upper end of the telescope upon the front fence, and with boxes, door mats, books, and papers placed upon the table raised the other end of the telescope to the proper angle. While I stood out in the road, gazing into the telescope, my wife stood in the yard holding and moving the instrument at my direction to follow the fast setting comet, while father placed books and papers underneath to keep the telescope in position.

"In this way my last observations were made. I followed the comet until it almost touched the distant horizon, and was enabled to telegraph the discovery the same evening by 8 o'clock, with three-quarters of a mile to go to reach the telegraph office. It was promptly cabled to Europe, and in a few hours the discovery was published throughout the civilized world."

Ruined by the Patent Register.

Moseby, who has been away from town for some time, returned the other day. Shortly afterward a friend met him, and noticing his seedy and low spirited appearance, asked:

"Moseby, what's the matter, old fellow?"

"Ruined."

"What?"

"A financial wreck."

"How did it occur?"

"Well, you see I had charge of a bridge not far from here. The owners are very particular about receiving every cent that is due them, so they put in one of those registers. It is a sort of fool arrangement sunk in the foot passageway of the bridge, and makes a mark with a clicking punch every time anybody steps on it. Well, everything was all right until the other day. A big Newfoundland dog got on the blamed thing and began to scratch himself, and, sir, before I noticed him he had charged me up $275. Yes, I am a ruined man."—*Arkansaw Traveler.*

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Photo Printing by Machinery.

Regarding the new method of printing by machinery, invented by Mr. John Urie, of Glasgow, having seen the machine at work, we are in a position to give such an account of it as will enable our readers to understand its action.

Externally the machine consists of a long box of about the dimensions of a foot and a half square, and of three times that length. In a recess in the center is fixed a pad, over which a long band of Alpha paper passes, as it is being unwound from a spool at one side upon a drum at the other. Surmounting this pad is a heavy metal frame containing the negative, this being hinged at one side so as to admit of its being raised when it is necessary to move the paper underneath; and above this in turn are two gas burners. Certain clockwork in the interior is actuated by two weights as the motive power.

The time of exposure is regulated by the adjusting of a barrel or drum containing spikes inserted in its periphery, and by which the duration may either be five seconds, three minutes, or anything between. To prevent the heating of the negative by the gas flames that are so near, a glass bottomed trough of water is interposed.

When we saw it in action, the following movements took place: The clockwork, when started, turned down the gas to a very low point, raised the weighty frame, in which the negative was fixed, to a height sufficient to enable the sensitive paper on the spool to be pulled forward a distance equaling the width of the negative, which was no sooner effected than the negative was immediately lowered again upon the paper, with which it remained in that close contact insured by the weight of its frame. Simultaneous with this movement the gas flames were turned up to their full power, and remained so during the period previously determined upon as that necessary for impressing the image on the paper, the whirr of the machinery being heard all the time. At the expiry of this predetermined period down went the gas, the negative being then raised and the paper drawn forward the requisite distance, when the negative resumed its place on the paper, the lights being turned up, and the whole process of exposure re-enacted.

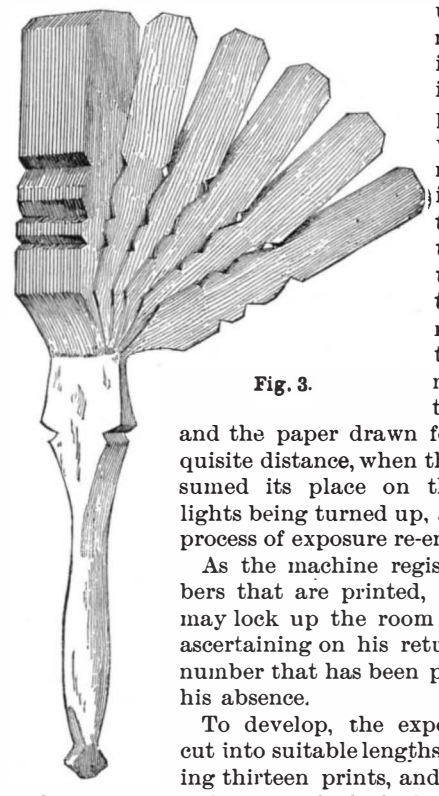

Fig. 3.

As the machine registers the numbers that are printed, the attendant may lock up the room and go away, ascertaining on his return the precise number that has been printed during his absence.

To develop, the exposed paper is cut into suitable lengths, each containing thirteen prints, and is placed in a bath of ferrous oxalate, by which the latent image becomes visible, at first very faintly, although it soon acquires great vigor. The band of prints having been washed is then transferred to a bath containing alum solution, in which it remains ten minutes. It is then placed in a gold toning bath, where it acquires any color desired. This tone may be determined with accuracy, as the prints undergo scarcely any change at all when, subsequently, they are fixed by hyposulphite of soda. It will be understood that one print is identical with another in vigor and tone, and that these qualities are quite under the control of the operator. As many as two hundred *cartes* or cabinets may easily be printed in an hour by one machine.

As regards quality of print, it is all that need be desired.—*Photo. Times.*

Best Plant for Holding Banks.

The best plant at present known for consolidating, by the interlacing of its roots, the loose soil of a newly made embankment is, according to M. Cambier (of the French Railway Service), the double poppy. While the usual grasses and clovers need several months for the development of their comparatively feeble roots, the double poppy germinates in a few days, and in two weeks grows enough to give some protection to the slope, while at the end of three or four months the roots, which are ten or twelve inches long, are found to have interlaced so as to retain the earth far more firmly than those of any grass or grain.

Though the plant is an annual, it sows itself after the first year, and with a little care the bank is always in good condition.

WHITTLED FANS.

If you had been passing a certain bustling and smoke-begrimed railroad depot, in a city not far from our great metropolis, during the pleasant summer days, you would have noticed an industrious blind man whittling away at a piece of wood which, when he had laid his knife aside, he dexterously twisted into a fan, much to the delight of the numerous small boys and other passers-by who were attracted by his peculiar occupation.

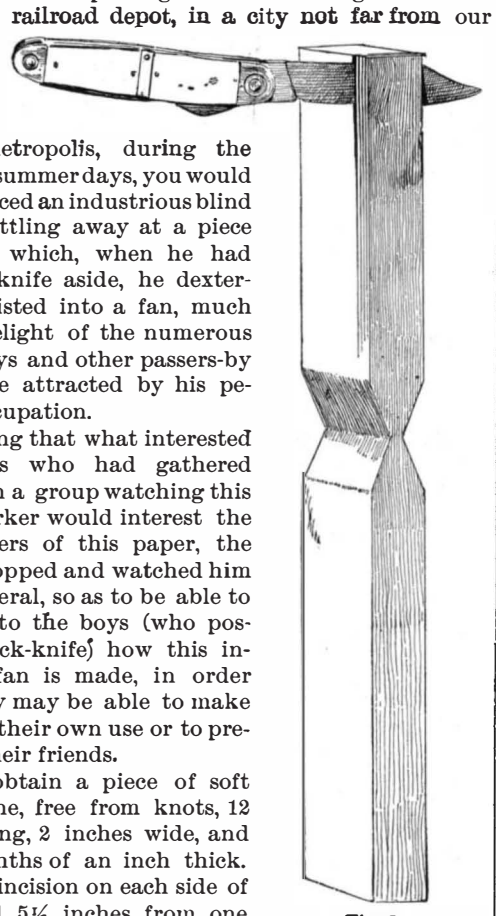

Fig. 1.

Thinking that what interested the boys who had gathered around in a group watching this blind worker would interest the boy readers of this paper, the writer stopped and watched him make several, so as to be able to describe to the boys (who possess a jack-knife) how this ingenious fan is made, in order that they may be able to make them for their own use or to present to their friends.

First, obtain a piece of soft white pine, free from knots, 12 inches long, 2 inches wide, and seven-eighths of an inch thick. Make an incision on each side of the wood 5½ inches from one end to the center of the incisions, and leave the wood a quarter of an inch thick between them (Fig. 1). Now split the shorter end of the wood downward (see knife in Fig. 1), as far as the two incisions, into sections one-sixteenth of an inch thick. Twenty-four parts or blades are needed to make a well proportioned fan. Cut off the surplus ones, half from each side, before making the handle.

The longer part of the wood is thinned down into a handle, any shape the maker desires (see Fig. 2). Now make three more incisions on the same flat sides as the first were made, beginning three-quarters of an inch above the handle. These incisions should be about a quarter of an inch deep, three-eighths wide, with a quarter of an inch of the flat surface left between each incision (Fig. 2).

Before bending the blades into shape the wood must be thoroughly soaked in water, or they will snap off while being bent.

When the wood is well saturated, begin to bend the blades on one side (as shown in Fig. 3) until the center is reached. Overlap the shoulder (made by the top incision) on the left side of each blade with the right of each succeeding blade. When one-half of the blades are in position, turn the fan to the other side and bend them in the same way. This will complete the fan (as shown in Fig. 4). V. S.

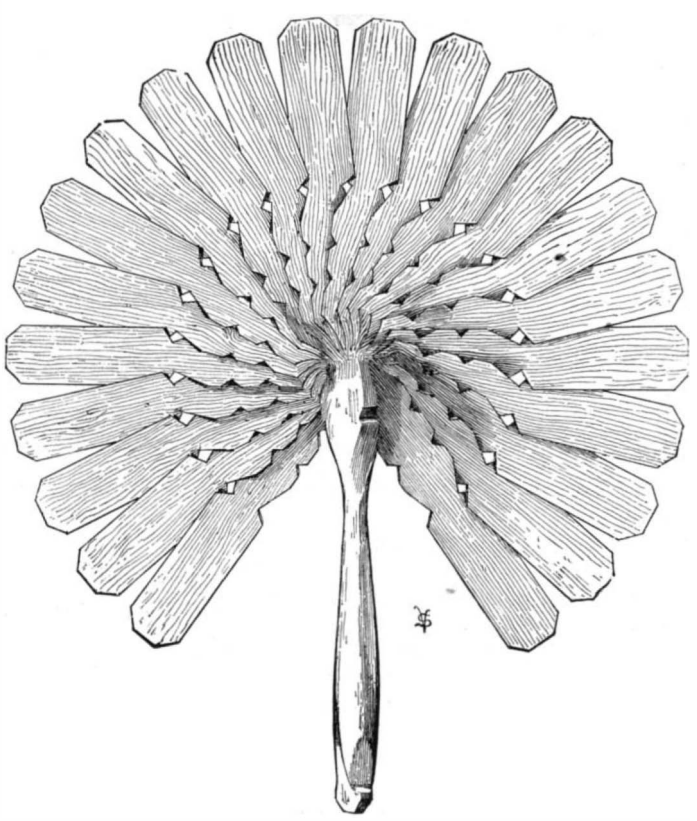

Fig. 4.

Navigating the Suez Canal by the Electric Light.

In presence of the continued increase in the traffic through the Suez Canal, even during the present commercial crisis, and to provide for the still greater increase that is anticipated in consequence of the abolition of the pilot dues and the lowering of the tariffs, by which merchandise now reaching Europe from the East and from Australia by the route round the Cape will be able to be sent through the Canal, the company has for the last two years been making experiments with electric lights, with a view to enable vessels to continue their passage through the canal during the night. These experiments (says the Paris correspondent of the London *Standard*) have at length proved so successful that it has been resolved to permit from the 1st of January next all vessels of war and postal steamers provided with the requisite electric lights to navigate by night that portion of the canal comprised between Port Said and kilometer fifty-four. Therefore, in almost half that portion of the canal where ships have to put into sidings to allow other vessels to pass them—in the Bitter Lakes vessels pass each other without stopping—vessels of war and mail boats, that together represent 22 per cent of the total traffic, will be able to continue their passage at all times of the day and night. This will constitute a great saving of time, and M. De Lesseps in his circular expresses the confident hope that the trial will be so successful as to enable him to authorize within a short time night navigation for all descriptions of vessels through the whole length of the canal.

Torpedo Experiments.

The London *Times* gives particulars of some important experiments carried out recently on the torpedo ground outside Portsmouth Harbor, in the Solent. Within the area of the torpedo field situated opposite the sea fronts of Forts Monckton and Gilkicker, near Portsmouth, an important experiment in submarine mining was carried out recently by Captain Markham and Commander Robinson, of the Vernon, on the part of the Royal Navy, and by Major Bucknill and Captain Wrottesley, on the part of the Royal Engineers. At each corner of a quadrilateral was sunk a heavy mine, consisting of 500 pounds of gun-cotton, inclosed in wrought iron cylinders, all four being in separate electrical connection with a battery on shore. The distances of the mines apart were the same as is usually observed in the navy as being within effective destructive range.

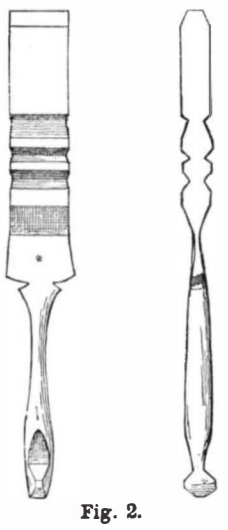

Fig. 2.

At various known distances from the charged mines were submerged a great number of cases of various construction loaded down with dummy gun-cotton as target mines, and the object of the experiment was to ascertain the effect upon the different structures of exploding heavily charged submarine mines in their neighborhood. Twelve of the targets consisted of simple Royal Engineer mines, lined with plaster of Paris and cement, also of electro-contact mines. The targets also included naval countermines, fixed mines, and electro-contact mines, service and experimental. Among others were samples of the ingenious mechanical fixed torpedo invented by Lieutenant Ottley, late of the Vernon, which sinks to a predetermined depth on being thrown overboard, and a solitary example of the mines which were manufactured in England for the use of the Chinese Government on the commencement of hostilities with France. This differs from the service pattern in form and material, being constructed of cast iron instead of wrought iron, and semicircular or umbrella-shaped in section, instead of cylindrical or spherical.

The various mines were all fixed buoyantly, and were destitute of blowing-up charges, as the purpose in view was not to discover whether the explosion of the heavy mines would detonate those in their midst, but to learn the comparative effects of the concussion on the containing vessels and gear, the force of the explosive at different ranges being measured by crusher gauges. Such heavy charges of gun-cotton, amounting in the aggregate to 2,000 pounds, and having an energy equal to about 8,000 pounds of gunpowder, had not previously been simultaneously discharged at Portsmouth. The charges were simultaneously exploded at a quarter past 12 on a half-ebb tide. As a spectacle the effect was somewhat disappointing. The spouts of water were almost connected, and were extremely jagged in outline, but they did not rise to the height expected, the stream of mud which overflowed the interior lining of the jets showing that the mines were scarcely buoyant at the time of the explosion. The detonation was not unpleasant on shore, but the radial extension of the disturbance must have been effective, as fish were stunned at considerable distances out to sea. The results of the experiment cannot yet be known, but it is believed that the Chinese mine is broken up.

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ENGINEERING INVENTIONS.

An oscillating engine has been patented by Mr. Douia C. Putnam, of Wayne Center, N. Y. The steam inlet and exhaust ports in the cylinder and the exhaust ports in the valve may be lengthened to any desired extent to permit quicker work in engines designed for any special duty, but the travel of the valve is in any case comparatively short, on account of the rocking movement of the cylinder.

A traction engine has been patented by Mr. Benjamin S. Benson, of Baltimore, Md. It has two obliquely arranged cylindrical boilers, with their higher ends in the middle and next to each other, the space beneath the cylinders forming the firebox, with hollow legs, which communicate with the water and steam space of the boilers, and the apparatus having an endless track chain with feet passing beneath, around, and over the boiler, with guide and truck wheels for the chain, to support the body of the engine and the track upon which it runs, with various novel features for reducing friction and facilitating the guiding of the engine.

AGRICULTURAL INVENTIONS.

A grain separator has been patented by Messrs. Francis Wadsworth and Henry N. Prentice, of Venice, O. It is intended to separate the straw and chaff from the grain at the same time, and then remove the unthrashed and partly thrashed heads and heavy impurities that may have passed through the thrasher and separator with the grain.

A seed planter has been patented by Mr. Louis S. Flatau, of Pittsburg, Texas. Its construction is such that as the planter is drawn forward the hopper and a stirrer wheel are revolved, the latter forcing seed out through discharge slots into a tube, through which and the tubular plow they fall into the bottom of the furrow opened by the plow, where soil is thrown upon it by covering plows.

MISCELLANEOUS INVENTIONS.

A lemon squeezer has been patented by Mr. Sheridan S. Badger, of Chicago, Ill. It has a fixed or stationary jaw, a hinged swinging jaw, and a handle or lever, so combined that the power from the commencement of the operation continues to be increased until the operation is completed.

A fire escape has been patented by Annie M. Jeffers, of Chicago, Ill. It is a spiral structure ranged along the windows of a buildings, and containing a ladder, being stretched or opened opposite the windows, and having safety chains at such openings, and also an alarm bell.

A pipe tongs has been patented by Mr. James J. Palmer, of Fall Brook, Pa. The invention consists essentially of tongs in which the binding contact surface is composed of a number of sections, and by removing or adding links or sections the tongs may be adjusted to fit almost any sized pipe.

A nail plate furnace has been patented by Mr. Simeon Bunn, of Belleville, Ill. It has double bottoms or decks, with openings, and outer walls with openings, so arranged that the products of combustion will be carried by a long, indirect passage, and the heat will be utilized to the greatest possible extent.

A reflector has been patented by Mr. James E. McLaughlin, of Portland, Oregon. It is for gas, lamp, or other artificial lights, and is so made that four concave reflectors, spun up from rectangular sheets of metal and polished, can be conveniently kept in the desired position behind a burner.

A tag making machine has been patented by Mr. Harmer Denney, of Brooklyn, N. Y. This machine takes the paper from a roll, and by a series of automatic operations the tags are printed, cut, eyeleted, cut off, and their corners beveled, the machine being readily adjusted to make tags of different widths.

A motor has been patented by Mr. Jackson B. Miles, of Lincolnton, Ga. It is a spring motor intended for use in connection with churns to operate the dasher staff, and when wound up the mechanism works from fifteen to forty-five minutes, according to the speed at which it is allowed to run.

A tongue support has been patented by Mr. Milo M. Russell, of Hayward, Wis. The running gear of a wagon and its tongue is combined with a spring of peculiar construction, with lever and detachable connections for holding the tongue, whereby provision is made for adjusting the tension of the spring, and the whole heft is equalized.

A necktie fastener has been patented by Mr. Daniel T. Freese, of North Amherst, O. It consists of a plate slotted twice to receive the tie, and with a forked arm bent over parallel with the slotted portion to receive the collar button, the arms of the fork being at right angles with the slots of the body of the plate.

A two wheeled vehicle has been patented by Messrs. William E. Davies and William C. Gayley, of Deringer, Pa. This invention consists in making the thills in two parts hinged together, with a spring attachment, to neutralize or overcome "horse motion," and relieve the horse to some extent of the weight upon his back

A belt punch has been patented by Messrs. Henry Bouchy and J. Henry Bamberger, of Newark, N. J. It has pivoted lever jaws, with a sliding tool in each handle end, and a revolving head carrying cutting devices on one of the jaws, with a rotary disk provided with punches, making a strong, cheap, and convenient tool.

A metallic bayonet scabbard has been patented by Mr. James McKenney, of New York city. It is made with an outwardly projecting flange upon the angular side of its upper end to overlap the edge of the throg, in such manner that the connection between the scabbards and the throgs will be firmer and more secure than with the ordinary construction.

A bellows has been patented by Mr. Jacob F. Weitzel, of Cincinnati, O. It is intended more especially for bee smoking, and comprises main plates of sheet metal bent at their edges, forming grooves or pockets, while the bag or flexible portion has its edges inserted and held in these pockets, with various other novel features.

A broom holder has been patented by Mr. James F. Barringer, of Bennettsville, S. C. A U-shaped plate and rod are so combined with cross pieces and arms as to make a holder in which broom straw or rattan can be clamped, as well as bagging, cotton waste, or rope, to form a mop, and one can be easily removed and replaced by others.

A safety device for elevators has been patented by Mr. Peter Moran, of New Orleans, La. The object of this invention is to prevent the water in the tanks of hydraulic elevators from being worked so low as to empty the pipes and allow the car or cab to fall, and to this end a novel construction and combination of parts is provided.

A nutmeg grater has been patented by Mr. Albert L. Platt, of Bowling Green, Mo. It consists in a revolving barrel made of a spiral coil of steel wire having notched outer edges, combined with a block having a hole through it and a counter bole or hole at right angles, to form a case in which the spiral cylinder revolves.

A land channeling roller has been patented by Mr. Robert H. Banks, of Fort Lewis, Col. It is so made that as the machine is drawn forward plows open furrows in the ground and ribs pack or roll the bottom and sides of these furrows, while another roller rolls the surface, so as to form channels for irrigation purposes in rolled land.

A sawing machine has been patented by Mr. Daniel W. Smith, of Long Lake, Mich. The machine is attached to the log to be sawed, and then by moving hand levers up and down a reciprocating motion is imparted to the saw through a shaft and pitman, the motion of the saw being directed by a guide, while the log may be raised, lowered, or turned, as desired.

NEW BOOKS AND PUBLICATIONS.

DYNAMO-ELECTRIC MACHINERY. By Silvanus P. Thompson. New York and London: E. & F. N. Spon.

This is a second and much enlarged edition of a volume published by the same author in 1884, which was itself based on the Cantor lectures of Professor Thompson before the Society of Arts, in 1882. The rapid multiplication of forms and perfecting of details in dynamo-electric machinery which has taken place in the last four years, is well illustrated in a comparison of the facts given in the lectures of 1882 with the accumulated material that is presented in the present volume of 500 pages. Almost every kind of dynamo which has attracted any considerable attention is here described with sufficiently full explanations of details to render an understanding of its construction and operation perfectly easy, even if one has never before made a special study of the subject. A good deal of attention is given to special forms of motors and their government, and to the testing of dynamos and motors. In the appendix is a short but very interesting chapter, covering statistics and comparisons of some recent dynamos, in which the author states that "the old pattern Brush machine gave only about 59 watts per pound of copper on the armature, while the new pattern Brush armature with the same field magnets gives about 90," and suggests that "if the field magnets were remodeled, and their cores made of soft wrought iron, the number of watts per pound of copper in the armature might be raised to 200 or more, and the old 40-light machine which, as now improved, supplies 60 arc lights, might then yield current for over 100 lights." The author also notes improvements in the Gramme machine from 87 watts per pound of copper in an old machine up to 306 watts in a late pattern, and asks correspondents for further statistical information of this character, "in view of the possibility of further editions of this work being called for at a future date."

THE DETERMINATION OF ROCK-FORMING MINERALS. By Eugene Hussak. New York: John Wiley & Sons.

The authorized translation of this German work has been made by Dr. Erastus G. Smith, of Beloit College, Wis., for use more especially by the students of colleges and universities. Part I. treats of the methods of investigation, including the preparation of microscopical sections and proper polarizing apparatus, giving optical and mechanical methods, and describing the mechanical separation of rock-forming minerals, while Part II. gives an elaborate series of tables for determining minerals, accompanied by a great number of figures.

METHODS OF RESEARCH IN MICROSCOPICAL ANATOMY AND EMBRYOLOGY. By Charles O. Whitman. Boston: S. E. Cassino & Co.

This volume is intended for everyday use in the zoological laboratory, to secure uniformity in practice according to the best methods of investigation, and the proper selection of the objects of study and obtaining the most complete information in regard to them. It gives preservative and macerating fluids, dyes, fixatives, mounting media, methods of embedding, etc., with descriptions of the different instruments used and comparisons of their respective advantages.

Received.

THE SCIENCE OF MIND APPLIED TO TEACHING (According to Phrenological Methods). By U. J. Hoffman. New York: Fowler & Wells Company.

TECHNICAL VOCABULARY, ENGLISH AND GERMAN. By F. J. Wershoven and A. Van Kaven. Leipzig: F. A. Brockhaus.

THE PANAMA CANAL: ITS HISTORY, POLITICAL ASPECTS, AND FINANCIAL DIFFICULTIES. By J. C. Rodrigues. New York: Charles Scribner's Sons.

NEW YORK AGRICULTURAL EXPERIMENT STATION: Third Annual Report of the Board of Control, for 1884. Albany, N. Y.: Weed, Parsons & Co.

IOWA STATE BOARD OF HEALTH: Third Biennial Report, for fiscal period ending June 30, 1885. Des Moines: George E. Roberts.

CONSPIRACY. A Cuban Romance. By Adam Badeau. New York: R. Worthington.

A FARMER'S VIEW OF A PROTECTIVE TARIFF. By Isaac W. Griscom. Published by the author, Woodbury, N. J.

Business and Personal.

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To Manufacturers.—The owner of 260 acres of ground at Pittsburg, on the Allegheny River and Pennsylvania system of railroads, in order to improve the property, offers to donate a number of excellent manufacturing sites. See adv. of Whitney & Stephenson, this issue.

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Grimshaw.—Steam Engine Catechism. A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

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Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 46.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

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Crescent Steel Tube Scrapers are made on scientific principles. Crescent Mfg. Co., Cleveland, Ohio.

Curtis Damper Regulator for draught and steam pressure in boilers. Curtis Regulator Works, Boston, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines. D. Frisbie & Co., Philadelphia, Pa.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv., p. 62.

English tanned Walrus Leather, Sea Lion, Oak, and Bull Neck Leather for Polishing. Greene, Tweed & Co., New York.

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Iron Manufacturers wishing to purchase large deposit of high grade magnetic ore, see adv. on page 78.

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Machinists' Pattern Figures, Pattern Plates, and Letters. Vanderburgh, Wells & Co., 110 Fulton St., N. Y.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) P. H. desires a stain to imitate cherry. A. Rain water 3 quarts, annatto 4 ounces; boil in a copper kettle till the annatto is dissolved, then put in a piece of potash the size of a walnut; keep it on the fire about half an hour longer, and it is ready to bottle for use.

(2) W. C. writes: In making a red or yellow stain with dragon's blood or turmeric, I want to tone these colors with a black, soluble in alcohol. A. You can probably purchase an aniline black that is soluble in alcohol, or else use logwood.

(3) F. F. K.—Old zinc battery plates can be melted in an iron pot and cast into plates in moulding sand, or may be cast in an iron mould. Zinc melts just below a red heat. If the zincs have been amalgamated, you should avoid inhaling the fumes rising from the heated metal.

(4) J. W. B. desires a recipe for some fire-extinguishing liquid. A. One of the best solutions for the extinction of incipient fires consists of crude calcium chloride 20 parts, salt 5 parts, dissolved in water 75 parts. Keep at hand, and apply with a hand pump.

(5) E. E. G. asks how to make a leaf bluing. A. Use unsized paper and any of the following solutions: 1. Dissolve indigo sulphate in water and filter. 2. Dissolve good cotton blue in cold water. 3. Dissolve Prussian blue with one-eighth part of oxalic acid in water. 4. Dissolve Tieman's soluble blue in water with 2 per cent oxalic acid.

(6) A Subscriber asks how to make spirit varnish suitable for varnishing carved wood. A. Take 1 ounce copal and ½ ounce shellac; powder them well, and put them into a bottle or jar containing 1 quart alcohol. Place the mixture in a warm place and shake it occasionally until the gums are completely dissolved; and when strained the varnish will be ready for use.

(7) C. J. C. asks: What is cut glass, such as is sold by dealers? A dealer here has two berry dishes that look alike, prices $1.00 and $20.00. One he calls cut glass and the other an imitation, with rough surface. A. Any glassware that has been ground in facets and repolished is cut glass. The kind that you sketch is very expensive when cut.

(8) W. A. E. asks how India ink (liquid), such as is sold in the art supply stores, is made. A. Dissolve shellac in a hot aqueous solution of borax and rub up in this solution a fine quality of India ink. Or rub down genuine India ink with good black ink until it will flow easily from the pen. See ink erasers, in article on inks, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157.

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(9) F. C. E. asks how to make a mould from which he can get one or two dozen castings in tin or its soft alloys. A. You may make a mould of iron or brass for casting tin or soft alloys. Plaster of Paris moulds will allow of a few castings, but are brittle and not reliable. If the mould can be cut easily, it can be made of soapstone.

(10) W. V. L. asks: Is it true that gold is one of the constituent parts of silver? A. Both gold and silver are elements, and theoretically are free from all admixture. In commerce they are generally alloyed with some harder elements. In mining, gold ore often yields a good proportion of silver.

(11) J. M. L. G. asks: 1. What is about the cost of the least complicated and plainest (and therefore the cheapest) lathes in the market? Also planer of the same description. Both to be durable and strong, for working iron. A. The price of lathes and planers varies so widely that it is impossible to name a price without knowing the size. A new or second hand lathe for iron work may be anywhere from $50 to $500. Planers about the same. Address makers and dealers who advertise in our columns for their lists of new and second hand machinery, stating about the size you want. 2. Is it injurious to slightly oil or grease boilers at night when quitting work? A. There is no harm in oiling the outside of your boiler. 3. Do the safety plugs (in the crown sheet) ever melt out when properly filled with metal, when well covered with water? A. Safety plugs have been known to melt by too hard firing with a thin sheet of water over them. Otherwise they are generally reliable.

(12) A. E. L.— Oberlin College, Ohio, Cornell University, Ithaca, N. Y., are institutions where part of the dues are taken in labor. We do not know of any institutions that provide for students wholly earning both board and tuition, but with the $300 you have saved, some knowledge of the machinist's trade, and plenty of pluck, we do not doubt you can get about as thorough a course as you may resolve upon.

(13) M. I.—Lignite may be readily pressed in bricks for burning, by the addition of a little tar or fluid pitch or asphalt. Crude oil does not dry readily, and might not be found practicable. Presses for this work are made in Pennsylvania.

(14) G. E. B. asks: Of what value would a knowledge of the process of hardening copper be to any one at the present time? A. Such a process would be very valuable if it can be done after the copper has been worked to shape or combined with other metals, as the linings of pump cylinders, hydraulic rams, and pistons, and for a thousand uses in running machinery. The hard alloys of copper are well known.

(15) F. W. asks the simplest way to tell how much a block and fall will safely carry. Also, how many men it would take to lift a certain weight with a 2 and 3 sheave block, and the difference with 3 and 4 sheaves and blocks; also, if ropes are measured round or through, and if there is a book on ropes and knots. A. With a pair of blocks of 2 and 3 sheaves respectively, you will have a leverage of 5 to 1, less the friction. With a pair of blocks of 3 and 4 sheaves respectively, the leverage will be 7 to 1, less the friction. New ropes will bear from 1,500 to 2,000 pounds as a safe load per square inch of section. A rope of 1 inch diameter will have ¾ of an inch section, and may be used for from 1,200 to 1,500 pounds load. Ropes are sold by their size in circumference. Thus a 3 inch rope is 0·95 inch diameter. A 2½ inch rope will be a little over ¾ inch diameter, etc. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 396, Rope Strains.

(16) T. H. G. writes: I have a mahogany table which has been varnished and has ink spots on it. 1. By what means can I get the varnish and ink off, in order to rub on an oil finish? A. The ink spots can be washed off with water and the varnish with alcohol. 2. What is best to polish carved brass? A. Polish with rotten stone and oil, alcohol, or spirits of turpentine. 3. What will remove water stains from polished marble? A. Mix quicklime with strong lye, so as to form a mixture having the consistency of cream, and apply it immediately with a brush. If this composition be allowed to remain for a day or two, and be then washed off with soap and water, the marble will appear as though it were new.

(17) F. A. C. desires a receipt for a harness cleaner and oiler. A. Take 2 ounces mutton suet, 6 ounces beeswax, 6 ounces powdered sugar candy, 2 ounces soft soap, and 1 ounce indigo or lampblack. Dissolve the soap in ¼ pint of water. then add the other ingredients, melt and mix together, add a gill of turpentine, lay it on the harness with a sponge and polish off with a brush.

(18) C. H. B.—The coarse emeries are sifted. You may buy sieves of brass for grades down to No. 80 or 90. After that, wash by placing the emery in a basin, pail, or tub, according to the quantity you wish to wash, with a small pipe attached to a hose from a water supply, and a faucet to regulate the flow; stir the emery at the bottom of the pail with the hose nozzle, allowing the water and fine emery to run over the side of the pail into a pan larger than the pail, and, if necessary, continue the overflow into two or three pans. The different pans will catch different grades of emery. Your own judgment and a little tact must be used in regulating the flow of water.

(19) L. S. P.—Height of Washington monument, 555 feet. The depth that a body sinks in sea water depends upon its density. Sea water weighs 64·312 pounds to a cubic foot, while fresh water weighs 62½ pounds to a cubic foot. From this a comparison of the floating capacities may be estimated. All bodies heavier than water go to the bottom at once, even to the greatest depths. The greatest depth yet reached is about 23,000 feet. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 398, for illustration of deep sea sounding apparatus. 6,000 to 10,000 pounds per square inch is the greatest hydraulic pressure we have heard of being used; 4,000 to 6,000 pounds per square inch in common use.

(20) C. B. writes: 1. I have an iron wash sink with a common trap and ¾ inch waste pipe leading to a cesspool in yard. When water is thrown in the sink, it does not run off readily; a pint would take two or three minutes, but, by lifting up the trap (strainer), the water bubbles up two or three times and then runs down all right. What is the trouble? A. The sink pipe is air bound, and the bubbling is caused by air escaping. The pipe should be ventilated between the trap and sink; vent should be outdoors. 2. What is sweet oil made of? A. Sweet oil is the oil of the olive, which grows in Spain, Italy, etc. 3. What is celluloid? A. The manufacture of celluloid, parkesine, and zylonite are described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 227. 4. Does the word "Redditch" on needle labels stand for the maker's name? A. Redditch is a trade mark. You may obtain prices through the jobbing trade in your city.—The sample you ask about is called pebble cloth, made by passing it through embossed calenders. Mastic varnish is proper for it.

(21) W. B. H. writes: Have you a recipe composed of linseed oil and resin, mixed, to make muslin semi-transparent and waterproof? A. Dissolve together white resin pulverized 8 ounces, bleached linseed oil 6 ounces, white beeswax 1½ ounces; add the turpentine while hot. Apply to both sides of the cloth while it is stretched tight. 2. How are the yellow oil proof coats made? A. The yellow jackets referred to are made by treating the cloth with a solution made by dissolving 1 ounce beeswax in 1 pint best linseed oil over the fire, applying it, when cold, with a piece of rag, rubbing it well in and then drying.

(22) S. G. W. writes: Sam Jones, the noted revivalist, is trying to make people believe that 13 worlds have been lost sight of by the astronomers, and it is a sure sign that one world or planet will soon be destroyed. Give your opinion. A. We do not think it follows that the stars referred to have been destroyed because they have been lost sight of. Astronomy cites many instances of stars appearing in the heavens attaining a high magnitude and then suddenly disappearing again. In some cases these phenomena have been observed to be periodic. We do not see that the destruction of the earth follows by analogy.

(23) J. J. W. asks: 1. The ingredients for a good water stain to imitate walnut? A. Burnt umber 2 parts, rose pink 1 part, glue 1 part, water sufficient; heat all together and dissolve completely; apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac. 2. A good jet black water stain. A. Pour 2 quarts boiling water over 1 ounce of powdered extract of logwood, and when the solution is effected 1 drachm of yellow chromate of potash is added and the whole well stirred. When rubbed on wood, it produces a pure black. 3. A good size for gilding with gold leaf, one to be ready for gilding in an hour. A. Good drying oil 1 pound, pure gum anime powdered 4 ounces. Bring the oil almost to the boiling point in a covered metal pot, add your gum gradually and cautiously to the oil, stirring all the time to dissolve completely. Boil to a tarry consistency and strain, while warm, through silk, into a warm bottle with a wide mouth. Keep it well corked; use as required, thinning with turpentine. 4. The compositition of the so-called oil finish? A. Boiled linseed oil 1 pint, yellow wax 4 ounces; melt and color with alkanet root.

(24) H. N. S. asks: Which is the faster—a toboggan or a sled (steel shod); assuming that the total weight is the same in each case, the incline of the coast the same, and each on a coast best adapted to it? Also, the reasons governing your reply. A. We should say the steel shod sled. Although the frictional resistance is independent of the area of contact (so much larger in the toboggan than in a sled) or the velocity of rubbing, and the intensity of pressure is the same, yet the rubbing surfaces of the toboggan present more asperities to interlock with those of the ice or snow than do the steel runners of a sled. Bodies having rough surfaces, those made of compressible material, and those of irregular surface and form exhibit greater friction, as these features are exaggerated.

(25) N. N.—Art work is so various in its specialties that we cannot venture on specific names without knowing what you should know, viz., what your taste leans to in art study. When a young man arrives at the age suggesting a feeling of responsibility, he should at once consult with his friends or those that know his habits, opportunities, and proclivities, as to the probability of his success in any trade or art that presents itself to his grasp. We believe that you have an excellent library in your town in which are to be found books on the trades and arts. Join it and read.

(26) C. R. asks whether successive coats of glue, applied hot to wood or articles of a woody nature, would permeate the material, giving it toughness and rigidity, or would said glue remain as a mere coating, not permeating? If the glue would not materially permeate, what would you suggest as a fluid that would permeate and produce rigidity and, at the same time, have a preserving quality? It is desired that the article should be very cheap and the process very simple. A. Glue will not penetrate wood sufficiently to affect its stiffness or rigidity. Boiling the articles in thin glue for a few minutes will allow the glue to penetrate slightly further than the mere brushing of the hot glue upon the surface. Whatever can be forced through the grain endwise, that would dry easily and of a glutinous nature, would stiffen the work. These processes are tedious and expensive.

(27) J. M. D. asks: Is there any virtue in the "divining rod," so called, as a means of determining the locality of hidden streams of water? A. None whatever. The bobbing of the stick is due to a muscular pressure by the holder.

(28) T. E. writes: I have a marine boiler in use on a steamboat that gives plenty of steam, but the motion of the engine (12 inches in diameter, 5 feet stroke) raises the water in said boiler at least 4 inches. There is a steam drum on top of boiler about 18 inches diam. and 24 inches high. Would an additional steam drum connected horizontally to top of drum now on boiler, with a three inch pipe, prevent the raising of water when the engine is in motion? If so, how large a drum would be necessary? Would this additional drum save fuel? My steam pipe is 3 inches. A. The additional steam drum will not help you. It will only add to the work of the boiler by condensing the steam. If your steam pipe and drum is naked, it should be felted. The raising of the water is, no doubt, a surging of the surface into waves by the action of the engine, which shows in the water gauge. This may be partially prevented or broken up by making another connection near the end of the boiler, between the boiler and the steam pipe, with a 2 inch or 2½ inch pipe. This will partially relieve the water under the dome from the reciprocating action of the engine. Felting the exposed parts of the boiler is also necessary to economy.

(29) L. H. R. writes: In a hydraulic ram for making lead pipe the water ram is eaten with grooves running vertically with the ram. This caused the water to leak so badly, I had a new ram cast. I now notice small grooves beginning in the same manner, which, in less than a year's time, will compel me to get another new ram, unless the evil is remedied. What is the cause? What is the remedy or preventive? The water used is from the Kansas River, and is not filtered; but if the cause was from sand or any gritty substance, it surely would ruin the leather packings before it would eat away the ram. A. The ram pistons in the lead pipe presses in New York and vicinity have a life of only about one year, wearing in grooves as you describe. The present practice is to cover the pistons with copper, which wears two to three years. Old pistons are also covered and recovered. If you have the old piston, you can have it covered. Gritty substances, as fine sand, iron rust, the hardening of the leather by absorption of iron, together with the great pressure, is the assigned cause of the cutting.

(30) C. R. desires a simple size for making decalcomanie or transfer paper. A. Use gelatin size. 2. Could I bake in a japan oven so that the transferred printing could be drawn slightly, like a blacking box lid? A. If the picture is coated with a transparent japan varnish, it can be baked same as any other varnish. If the japan is quite thin, the metal may be drawn.

(31) H. L. writes: 1. I wish to melt a gold coin in a sand crucible, and want instructions how to proceed. A. Break into small pieces, mix with borax, and expose it in the crucible. 2. Is there danger of heating too hot? A. No. 3. Can I remedy its tendency to crack? A. Only by proper annealing. 4. I have seen gold coin as yellow as brass and some almost as red as copper. What is the cause of so much difference in color? A. The red color is due to its being alloyed with copper. The natural color is yellow, but it becomes red by the addition of copper. See "The Practical Gold Worker," by George Gee, which we can send for $1.75.

(32) J. G. H.—We could not recommend a steam pump to be used once a fortnight. It would never be in order for running. A small low pressure steam pump in the market will cost about $125. We consider gasoline a dangerous element in its liquid state, in the vicinity of fire. Its vapor, mixed with air, as used for lighting purposes, where the vaporization is carried on outside of the premises, will be safe if burned in jets in a stove.

(33) J. C.—A first class ice boat, sailing on first class ice, will sail from three to four times faster than the wind that drives the boat. For example, a wind having a velocity of fifteen miles an hour will drive the boat at the rate of from forty to sixty miles an hour.

(34) W. H. O. desires a formula for making white miners' oil, for burning in lamps. A. Take 50 to 60 per cent mineral, seal, or some other 300° oil and from 40 to 50 per cent of pure lard oil. A cheaper article is made by using 40 to 50 per cent cotton or rape seed oil.

(35) E. W. asks: What is a good, cheap substitute for beeswax to coat wooden patterns for use but a few times, something that can be applied with a brush, without heat? A. Shellac varnish. 2. What is a good flux for welding iron in a blacksmith's fire, and the desirable qualities of coal for same? A. Clear white sand or borax. Use best Cumberland coal, free from sulphur.

(36) J. C. writes: I am burning in my boiler slabs that are saturated with salt water, and find that the tubes of the boiler have to be cleaned out every few days on account of the salt, which is coated heavily upon them. Is there any danger of the salt eating into them or doing any injury? A. The burning of salt fuel under boilers may not materially affect the iron while the boiler is in use, but may make a coating or form a coat upon the surface of the tubes by the condensation of the evaporated salt that will be troublesome to clean off. When the boiler is not in use, the salt crust will absorb water and rust the tubes. A close examination of the rear end of the boiler and tubes will show whether the tubes are accumulating a crust that the tube brush does not remove. If so, better abandon the use of salt fuel. The dry salt does not affect the iron. The salt absorbs water when the boiler is cold, when rust takes place.

(37) J. S.—Cast or tool steel cannot be welded together with any certainty. Low grade steel that will harden, such as shear and double shear, can be welded together fairly with borax and sal ammoniac or borax alone, which are also good for welding steel to iron. Use about one-tenth sal ammoniac, pulverized with the borax and heated to evaporate the water, then pulverize again and weld with the powder.

(38) E. M. asks (1) what to add to hair oil that will give the hair a yellow color. I have very light hair, and would like to color it a darker shade. A. A bismuth hair dye is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 356, which is not considered injurious at all to the head. 2. Give me a remedy to purify the blood. A. We would refer you to a physician for a remedy of this character. 3. A good toilet soap. A. See "The Manufacture of Toilet Soaps," contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 518 and 519.

(39) P. M. A. asks: Would you please give some remedy whereby tattoo marks may be completely expunged? A. We know of no means by which they can be completely removed. Pricking in milk, in some cases, rather fades them.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 12, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading machine, C. K. Bradford 333,991
Acid, apparatus for distributing, etc., liquid carbonic, Convert & Rueff 334,351
Acid, manufacture of salicylic, R. Schmitt 334,290
Aging spirituous liquors, wines, etc., apparatus for, H. A. Fitch 334,222
Air brake for railway cars, electro-magnetically operated, H. Hollerith ..... 334,020 to 334,022
Air compressor, L. S. Chichester 333,994
Air or gas engine, G. H. Babcock 334,152, 334,153
Air and gas engines, operating, G. H. Babcock 334,155
Air or gas engines, operating, G. H. Babcock 334,154
Animal trap, W. E. Maultby 334,259
Animal trap, G. F. Voester 334,096
Automatic brake, J. T. Honeycutt 334,384
Axle box, car, W. Sutton 334,205
Bag and twine holder, combined, J. Duls 334,358
Bagasse furnace, W. W. Sutcliffe 334,204
Baling press, P. K. Dederick ..... 333,999 to 334,005
Barrel filler, J. McKenzie 334,268
Bellows, J. F. Weitzel 334,319
Belts, slide for sword, F. T. Buffum 334,101
Bicycle, J. L. Yost 334,325
Bicycle seat, C. M. Clarke 334,164
Billiard chalk holder, W. Zaehringer 334,099
Block. See Hat finishing block. Pulley block. Sawmill head block.
Boiler. See Steam boiler.
Boiler, W. C. Pennock 334,277
Book rest and stand, folding, Walker & Crayton 334,313
Boot and shoe burnishing machine, H. Nelson 334,394
Boot and shoe nail, A. Eppler, Jr 334,361
Boot or shoe, J. J. Feeney 334,364
Boot or shoe buffing roll, C. K. Bradford 334,162
Boot or shoe creeper, L. C. Hoffmeister 334,381
Bottle stopper, R. Bloeser 334,334
Bottle stopper fastening, H. P. Brooks 334,100
Bottling machine, W. F. Dorflinger 334,357
Box. See Cash box. Folding box.
Bracket. See Easel shelf bracket.
Brake. See Automatic brake.
Brick drying structure, J. K. Caldwell 334,107
Bridge gate, automatic draw, W. S. Morton 334,084
Bridle blind, A. F. Ransom 334,050
Bridle, harness, M. R. Good 334,168
Broom corn, compound for softening and dyeing, J. A. Van Winkle 334,140
Broom holder, J. F. Barringer 334,214
Brush, J. F. Bowditch 334,336
Brush backs, device for inserting bristles in, E. Kipper 334,121
Brush making machine, J. M. Pickering 334,086
Building material, form of, J. S. Armstrong 334,401
Bustle, A. M. Belden 334,332
Button, I. G. Platt 334,191
Button or stud, T. B. Cleveland 334,349
Button setting machine, Wilkins & Bartlett 334,321
Cable grip, roller, G. A. Polhemeus (r) 10,677
Calculating machine, E. W. Watson 334,064
Can counting machine, E. Norton 334,273
Can delivering device, automatic, E. Norton 334,274
Capsule machine, J. Krehbiel 334,240
Car coupling, M. Dill 334,355
Car coupling, D. M. Harris 334,169
Car coupling, L. B. Kenney 334,388
Car starter, C. F. Dodge 334,111
Cars, street indicator for, Beaver & Jewitt 334,331
Carbons, apparatus for treating, E. Weston 334,146
Carpet fastener, F. C. Hellmuth 334,170
Carpet stretcher, Keller & Wiley 334,174
Carpets, etc., fastening for, D. M. & J. E. Smyth 334,138
Carriage, baby, J. W. Griffin 334,372
Carriage, baby, J. R. Moore 334,030
Cash box, self-registering, T. Carney 334,347
Cast wheel, pulley, etc., M. D. Loomis 334,178
Casting box, stereotype, Pratt & Partridge 334,048
Casting stench traps, mould for, E. H. Murdock 334,033
Chair. See Spring chair.
Chair, J. W. Price 334,087
Chimneys on burners, device for holding and locking, J. R. Bowers 334,161
Churn, W. Jarrell 334,229
Cider machine, M. K. Brubaker 334,343
Circuit changer, automatic, E. T. Gilliland 334,014
Clamp. See Sucker rod clamp.
Clamping device, spring, I. W. Heysinger 334,016
Cleansing machine, T. H. Page 334,132
Clip. See Traveling bag clip.
Clock escapement, C. Becker, Sr 334,068
Clock gong and bell, G. Gardner 334,012
Clothes pounder, Hill & Crooker 334,379
Cock box, stop, B. C. Smith 334,137
Collar fastening, horse, Gillespie & Cassan 334,370
Colors, manufacture of archil-red azo, C. A. Martius 334,257
Connecting rod, bearing pin, L. H. Nash 334,036
Connecting rod for pistons, etc., L. H. Nash 334,035
Cooling and disinfecting apparatus, L. H. Latimer 334,078
Cork extractor, Tobias & Shoesmith 334,061
Corset, K. Dunham 334,359
Counter and show case, combined, S. B. Dooley 334,356
Coupling. See Car coupling. Detachable coupling. Hub and axle coupling.
Coupling joint, B. F. Sweet 334,305
Cuff holder, F. E. Kohler 334,391
Cultivator, S. L. Allen 334,327
Cultivator, M. F. McCray 334,181
Cultivator, W. C. Peters 334,045
Cutter. See Meat cutter.
Desk and seat, combined adjustable, A. B. Irvin 334,171
Detachable coupling, W. E. Link 334,256
Door attachment, sliding, W. Spear 334,208
Door hanger, C. W. Bullard 334,344
Draught equalizer, J. L. Powles 334,280
Drum, heating, M. N. Kimble 334,075
Dyed, machine for condensing warps for being, I. F. Lawry 334,122
Easel shelf bracket, T. P. Watkins 334,065
Eaves trough, W. C. Berger 334,160
Electric alarm apparatus, C. H. Hilton 334,380
Electric light, multiplex, A. C. Ferguson 334,365

© 1886 SCIENTIFIC AMERICAN, INC

Electric arc light, Gage & Crary..... 334,073
Electric lighting apparatus, A. C. Ferguson..... 334,366
Electrical indicator, E. Weston..... 334,145
Elevator attachment, L. Senior..... 334,201
Elevator safety device, P. Moran..... 334,083
Elliptic springs, machine for setting bands on, E. Spaulding..... 334,397
Embossed fabric for upholstery, etc., W. Sochefsky..... 334,300
Engine. See Air or gas engine. Gas engine. Motor engine. Oscillating engine. Rose engine. Rotary engine. Traction engine.
Extension table, H. F. Burmester.....334,103, 334,104
Fan, automatic, J. W. Rykard..... 334,056
Fanning mill, A. Mekelburg..... 334,183
Faucet, P. Schofield..... 334,291
Feed cutter feed chain, P. Fisher..... 334,367
Feed regulator, L. C. Shroeder..... 334,092
Feed water heater, H. Poe..... 334,192
Feed water heater, O. Rothrock..... 334,197
File cutting machine, C. M. Fairbanks..... 334,115
Fire alarm indicator, W. C. Walter..... 334,399
Firearm, magazine, Larsen & Winterros..... 334,244
Fire escape. A. M. Jeffers..... 334,230
Fire escape, W. G. Ketchum..... 334,237
Fireplace, E. R. Procter..... 334,088
Fireproof garment, J. W. Elliot..... 334,360
Flour and bread, preparing gluten, J. E. Lauer.... 334,245
Flour bolt, A. Y. Leake..... 334,246
Folding box or crate, A. Harris..... 334,375
Frame. See Neckwear frame.
Furnace. See Bagasse furnace. Nail plate furnace. Portable furnace. Smoke consuming furnace.
Furnace, G. A. Clark..... 333,995
Furnaces, tapping hole for, G. W. Goetz..... 334,015
Gauge. See Sewing machine gauge. Sirup gauge.
Gauge and clamp for weather boarding, etc., W. Ervin..... 334,363
Gauges, face plate for marking, J. A. Traut..... 334,308
Galvanic batteries, manufacture of earthenware tanks or cells for, F. W. Meeker..... 334,027
Garment supporter, E. Thompson..... 334,307
Gas engine, L. H. Nash..... 334,039
Gas engine governor, L. H. Nash..... 334,038
Gas engines, feeding and operating, L. H. Nash... 334,040
Gas furnace, W. Swindell..... 334,306
Gas making apparatus, T. F. Martin..... 334,127
Gas or water regulator, B. Franklin..... 334,011
Gas saving device, G. W. Reed..... 334,286
Gate, T. Rodecker..... 334,287
Gear, reversing, G. S. King..... 334,238
Governor for motors, J. Dow..... 334,112
Grain separator, Wadsworth & Prentice..... 334,312
Grate, endless chain, T. Poore..... 334,047
Grater, nutmeg, A. L. Platt..... 334,279
Grater, nutmeg, J. M. Smyth..... 334,298
Grinding rolls, machine for dressing, F. Messer.. 334,262
Hame, C. H. Allen..... 333,988
Hammer, copper tipped, H. A. Randall..... 334,283
Handle for satchels, etc., W. Roemer..... 334,196
Hanger. See Door hanger.
Harness breast strap, I. A. Miller..... 334,128
Harness trimming, G. F. Eberhard.....334,006, 334,007
Harrow, C. A. Brostrom..... 334,342
Harrow, F. J. Marshal..... 334,180
Harrow, H. H. Sater..... 334,054
Harrow, wheel, H. L. Easley..... 334,165
Harvester finger bar attachment, Hamilton & Perrigo..... 334,374
Hat brim curling machine, R. Eickemeyer..... 334,221
Hat finishing block, C. E. Keator..... 334,236
Hay rake and loader, C. P. Slaght..... 334,093
Hay stacker, J. S. Rayl..... 334,193
Heater. See Feed water heater. Steam heater.
Holder. See Bag holder. Billiard chalk holder. Broom holder. Cuff holder. Mucilage holder. Pillow sham holder. Rein holder. Tool holder.
Horse power, S. G. Hoekstra..... 334,074
Horses from harness and vehicles, device for releasing, O. W. Wade..... 334,097
Horses, sweat scraper for, G. W. Sandford..... 334,198
Horseshoe, G. G. Shroeder..... 334,200
Hose, J. Jones..... 334,233
Hose, machine for winding wire upon, I. W. McGaffey..... 334,026
Hot air furnace, Van Stone & Taylor..... 334,310
Hot air furnace casing, S. N. Betts..... 333,989
Houses, constructing frame, E. Totman (r)..... 10,678
Hub and axle coupling, vehicle, J. Raddin..... 334,049
Hydraulic jack, Weeks & Traver..... 334,206
Ice machine, A. R. Kenney..... 334,120
Incandescent, E. Weston..... 334,142
Indicator. See Fire alarm indicator.
Injector, H. B. Murdock..... 334,266
Injector, W. B. Mack..... 334,124
Injector, steam, J. Desmond..... 334,354
Ink well cover, Whitman & Brown..... 334,148
Jack. See Hydraulic jack. Wagon jack.
Jig, machinist's, J. Brady..... 334,340
Joint. See Coupling joint. Rail joint.
Journal bearing for crank connecting rods, L. H. Nash..... 334,034
Kitchen cabinet, L. May..... 334,260
Knitting machine, J. L. Branson..... 334,338
Lamp, C. H. Higbee..... 334,018
Lamp burner, C. H. Higbee..... 334,017
Lamp collar, W. B. Palmer..... 334,043
Lamp, electric, F. G. Waterhouse..... 334,317
Lamp, electric arc, Dales & Adams..... 334,353
Lamp, electric arc, E. Weston..... 334,144
Lamp extension device, Lang & Graeter..... 334,243
Lamp, gas, J. W. Baker..... 334,328
Lamp regulator, arc, J. A. Jenney..... 334,023
Lamp shades, etc., forming block for making, Mahoney & Louvet..... 334,126
Lamps, testing incandescent electric, E. Weston.. 334,147
Land channeling roller, R. H. Banks..... 334,213
Leather skiving machine, J. D. Humphrey..... 334,119
Lemon squeezer, S. S. Badger..... 334,212
Level, grading, C. Willgansz..... 334,149
Level, spirit, Reid & Thayer..... 334,052
Light. See Electric light. Electric arc light.
Lock. See Seal lock.
Log turner, H. C. Basim..... 334,330
Loom let-off mechanism, R. E. Waterhouse..... 334,063
Lubricator, O. Williams..... 334,323
Marble sawing machine, J. F. Coyne..... 334,217
Marine way, J. E. Staples..... 334,094
Meat cutter, T. Lyons..... 334,123
Mechanical movement, W. C. Bramwell..... 334,341
Mechanical movement for converting motion, A. Kaiser..... 334,173
Metal wheels, making, J. R. Little..... 334,253
Metal wheels, mechanism for manufacturing, J. R. Little.....334,250, 334,251
Metal wheels, mechanism for the manufacture of, J. R. Little..... 334,254
Metals, apparatus for filtering and separating, J. P. Wetherill..... 334,207
Metals, filtering and separating, J. P. Wetherill... 334,208
Metallic wheel, J. R. Little.....334,249, 334,252
Microscope, C. Fasoldt..... 334,009
Mill. See Fanning mill. Roller mill. Rolling mill.
Mitering machine, J. G. Leffingwell..... 334,247
Motion, device for converting reciprocating into rotary grip and slip, W. T. Kosinski..... 334,392
Motor, J. B. Miles..... 334,263
Motor engine worked by combustible gases or petroleum, G. Daimler..... 334,109
Mucilage holder, C. S. Pinkham..... 334,046
Nail. See Boot and shoe nail.
Nail plate furnace, S. Bunn..... 334,216
Nail machine, wire, H. B. Lester..... 334,248
Neckwear frame, E. C. Cooke..... 334,352
Necktie fastener, D. T. Freese..... 334,224
Nozzle, spray, E. J. Delaney..... 334,110
Nut lock, O. L. Castle..... 334,070
Nut lock, J. F. M. Morse..... 334,031
Nut lock, L. & C. Staples..... 334,058
Oil upon the sea at harbors, docks, etc., apparatus for distributing, J. Shields..... 334,295
Oiler, car axle, J. Gibbons..... 334,013
Oscillating engine, D. C. Putnam..... 334,282
Packing for engines, plunger, L. H. Nash..... 334,037
Paint and varnish, J. W. & F. R. Hoard..... 334,019
Paper drier, H. Winterwerber..... 334,150
Paper making machine, W. F. Edwards..... 334,072
Parasol or umbrella, D. C. Fischel..... 334,368
Parer, slicer, and corer, apple, W. W. McMillan... 334,130
Patten, H. Holland..... 334,383
Pavements, joint marking and dressing tool for cement, M. Macdonald..... 334,125
Pencil sharpener, W. H. Lamson..... 334,242
Pillow sham holder, C. F. Percival..... 334,278
Pin, M. E. Grow..... 334,373
Pipe wrench, W. Hellem..... 334,227
Pipe wrench, H. L. Housholder..... 334,387
Pipes, frost proof ventilator for soil and other, T. C. Boyd..... 334,337
Plaiting machine, G. & J. H. Taylor..... 334,060
Plane, J. Woods..... 334,324
Planter, corn, J. P. Webb..... 334,318
Planter, seed, L. S. Flatau..... 334,223
Plow, J. M. Burrows..... 334,106
Plow, sulky, A. F. Cass..... 334,348
Plow, sulky, S. W. Gutridge..... 334,117
Polishing material, feeder for, H. W. Smith..... 334,296
Portable furnace, S. L. Wiegand..... 334,400
Power. See Horse power.
Press. See Baling press. Seal press.
Pressure regulator, fluid, W. J. Acheson..... 334,326
Printing machine, plate, O. S. Harmon..... 334,225
Printing plates, producing, C. F. Josz..... 334,234
Privy and attachments, P. Anthony..... 334,151
Pulley block, G. W. Clark..... 334,071
Pulley, expanding, J. M. Herman..... 334,377
Pulverizer for drugs, etc., R. W. Seger..... 334,292
Pulverizing machine, J. R. Woodburn..... 334,098
Pump, H. M. D. L. Babcox..... 334,211
Pump pressure regulator, steam, W. B. Mason, 334,079, 334,080
Pump valve, Burch & Scovill..... 334,105
Punch, belt, Bouchy & Bamberger..... 334,215
Punching and feeding scraps of sheet metal, machine for, C. M. Platt..... 334,190
Punching machine, H. Tay..... 334,139
Punching machine, check, J. M. Montgomery, Jr. 334,264
Quilting bed comfortables, etc., machine for, F. L. Palmer..... 334,275
Rail joint, J. Shipley..... 334,056
Railway tie, E. N. Higley..... 334,228
Railway tracks, splice bar rail chair, for street, A. J. Moxham..... 334,265
Railways, automatic alarm signaling and safety device for, E. E. Ries..... 334,194
Railways, overhead conductor for electric, C. J. Van Depoele..... 334,062
Rake. See Hay rake.
Reflector, J. E. McLaughlin..... 334,270
Regulator. See Feed regulator. Gas or water regulator. Lamp regulator. Pump pressure regulator. Speed regulator.
Rein holder, W. E. Barber..... 334,067
Relay, polarized, L. J. Phelps..... 334,185
Rocking chair attachment, W. I. Bunker, 334,102, 334,345, 334,346
Roller. See Land channeling roller.
Roller mill, E. C. Keyser..... 334,389
Rolling mill, J. Pedder..... 334,044
Rose engine, A. Zemann..... 334,210
Rotary engine, C. P. Jurgensen..... 334,235
Rudder brake, liquid, McColl & Cumming..... 334,081
Saddle, harness, A. Gilliam..... 334,116
Salve, A. Meyer..... 334,028
Sash balance, H. R. Bridges..... 333,992
Saw guide, band, W. Kratzer..... 334,175
Sawmill feed mechanism, T. J. Reamy..... 334,285
Sawmill head block, T. J. Reamy..... 334,284
Saw tooth, insertible, A. Krieter..... 334,241
Saw tooth insertible oscillating, Swank & Dages.. 334,303
Sawing machine, D. W. Smith..... 334,297
Sawing machine, circular, J. F. Welch..... 334,141
Scabbard, metallic bayonet, J. McKenney..... 334,269
Scale, pivot, J. S. Redline..... 334,051
Scale, proportional weighing, E. L. Rowe..... 334,288
Scraper, J. T. Boyd..... 333,990
Scraper, clod guard, and gauge, combination, W. B. Miller..... 334,082
Scraper, road, E. Lathrop..... 334,177
Seal lock, G. H. Steadman..... 334,302
Seal press, C. L. Pond..... 334,395
Seeding machine, P. E. Rogers..... 334,396
Separator. See Grain separator.
Sewer trap, D. Higgins..... 334,378
Sewer trap or ventilator, G. W. Beard..... 334,158
Sewing machine attachment, E. S. Harris..... 334,118
Sewing machine gauge, H. C. Curtis..... 334,218
Sewing machine trimming attachment, J. W. Eastwood..... 334,114
Sheet metal, machine for scouring and drying, F. J. Wooster..... 334,209
Shelving and counter, portable, D. W. McElroy... 334,267
Shoe, S. C. Tribou..... 334,398
Shoe uppers, machine for beading, C. B. Hatfield. 334,376
Sickle, endless reaping, Sweeney & Ghormley..... 334,304
Sifter, ash, C. Japtok..... 334,172
Signal. See Torpedo railway signal.
Signals, etc., mechanism for controlling, H. Johnson *et al*..... 334,232
Sirup gauge, J. Brown..... 333,993
Skate, roller, H. S. Combs..... 333,996
Skate, roller, G. F. Johnson..... 334,231
Skate, roller, O. J. Punches..... 334,281
Skips or wagons, discharging and righting, J. Kitto *et al*..... 334,076
Smoke consuming furnace, T. S. Wilkin..... 334,066
Smokestack, W. H. Garlock..... 334,369
Sodawater apparatus, L. Beretz..... 334,159
Spark ejecting device, H. M. Smith..... 334,202
Speed regulator for shafts of circular saws, etc., W. A. Baker..... 334,329
Spindle bolster, Greene & Young..... 334,371
Spinning machine spindles, bobbin holder for, J. Davis..... 333,997
Spring chair and seat, T. D. Davis..... 333,998
Spring trap, J. Vasseur, Jr..... 334,311
Stamp, hand, V. H. Emerson..... 334,008
Starch, manufacture of, J. C. Schuman..... 334,090
Steam boiler, J. Baird..... 334,156
Steam boiler agitator, H. B. Meech..... 334,132
Steam engines, pitman attachment for multiple-cylinder, M. N. Lynn..... 334,025
Steam heater, upright, W. F. Boswell..... 334,335
Steam trap, R. Newton..... 334,272
Stocking blank, Branson & Brinton..... 334,339
Stopper. See Bottle stopper.
Stove and range door, A. C. Mason..... 334,258
Stove leg, D. E. Paris..... 334,134
Stoves, end shelf for, D. E. Paris..... 334,135
Strainer and cut-off, Hough & Hoffman..... 334,386
Strap. See Harness breast strap.
Straw stacker, C. N. Leonard..... 334,402
Sucker rod clamp, W. Hellem..... 334,226
Supporter. See Garment supporter.
Switch or circuit controller, E. Weston..... 334,143
Syringe, Ward & Sylvester..... 334,316
Syringe valve, C. A. Tatum..... 334,059
Table. See Extension table.
Table leaf support, W. Kline..... 334,239
Tag making machine, H. Denney..... 334,220
Target, O. F. Seibold..... 334,293
Telegraph, printing, R. J. Sheehy..... 334,294
Telegraph, railway car, L. J. Phelps.....334,186 to 334,189
Telephone, acoustic, C. D. Bentley..... 334,069
Telephone call, individual, J. H. Kinsman..... 334,390
Thrashing machine feed regulator, A. W. Lockhart..... 334,024
Thread, machine for polishing silk and other, C. B. Trescott..... 334,309
Threads of hanks or skeins, mechanism for opening and separating, P. Durancon..... 334,113
Ticket, store service, C. Baum..... 334,157
Time ball and apparatus, W. F. Gardner..... 334,167
Tire for vehicle wheels, ice, T. B. Williams..... 334,322
Tire upsetting machine, J. R. Little..... 334,255
Tobacco plant setter, J. B. Mitchum..... 334,029
Tongs, pipe, J. J. Palmer..... 334,276
Tongue support, M. M. Russell..... 334,289
Tool holder, E. F. Noyes..... 334,042
Torpedo railway signal, T. G. Palmer..... 334,153
Traction engine, B. S. Benson..... 334,333
Trap. See Animal trap. Sewer trap. Steam trap.
Trap for baths, basins, etc., E. S. McClellan..... 334,129
Traveling bag clip, W. Roemer..... 334,195
Valve, J. Walsh, Jr..... 334,314
Valve, balanced, E. B. Sintzenich..... 334,136
Valve, engine, G. Schuhmann..... 334,089
Valve, steam-actuated, W. M. Cary..... 334,108
Valve, stop, J. Walsh, Jr..... 334,315
Valve, straight-way, J. T. Paget..... 334,184
Valves, safety stop for throttle, G. E. Messer..... 334,261
Vapor burner, O. Ewert..... 334,166
Vapor engines, operating explosive, L. H. Nash... 334,041
Vehicle, spring, H. A. Moyer..... 334,032
Vehicle, two-wheeled, Davies & Gayley..... 334,219
Vehicle, two-wheeled, N. W. Sherman..... 334,091
Vehicle wheel, Stahl & Rosebaugh..... 334,301
Vise jaw, E. Shaw..... 334,055
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Wagon, C. Hotz..... 334,385
Wagon body, P. A. McVicar..... 334,271
Wagon jack, W. N. Springer..... 334,057
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Water, device for automatically gauging the flow of, C. N. Tibbitts..... 334,095
Watermarks, producing, C. M. Schmidt..... 334,199
Weaner, calf, H. W. McNeal..... 334,131
Weaving apparatus, hand, E. Wernicke..... 334,320
Wheel. See Metallic wheel. Vehicle wheel.
Wheel, E. T. Burgess..... 334,163
Wheel, J. B. McCune..... 334,393
Wire burring machine, A. Eppler, Jr..... 334,362
Wrench. See Pipe wrench.
Wrench, D. Follett..... 334,010
Wrench, H. A. Larsen..... 334,077
Wrench, J. D. Otstot..... 334,085

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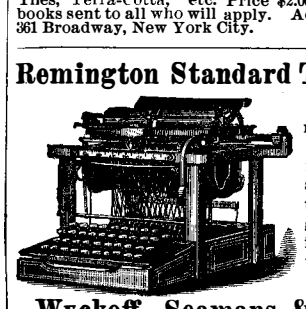

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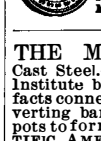

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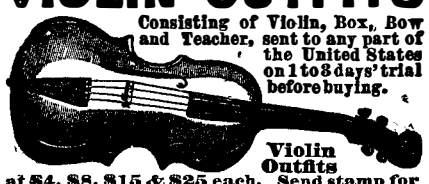

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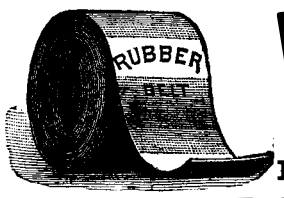

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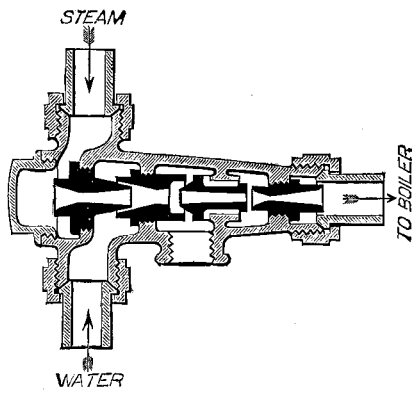

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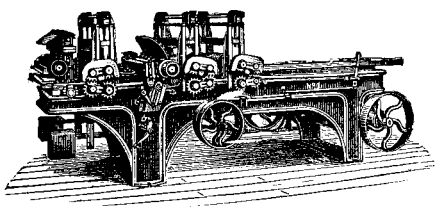

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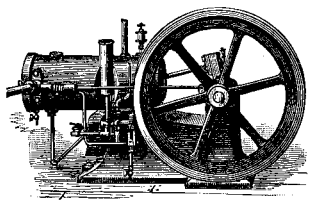

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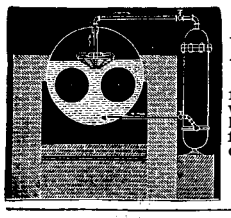

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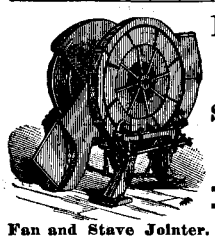

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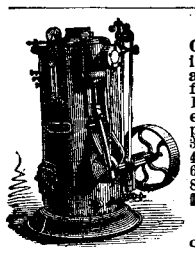

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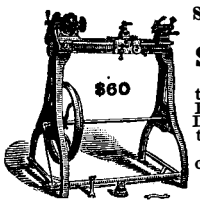

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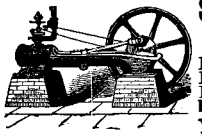

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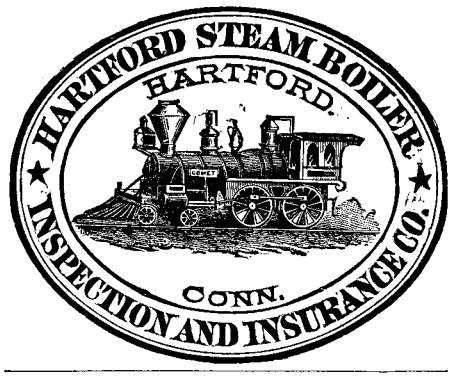

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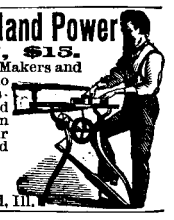

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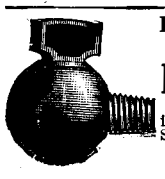

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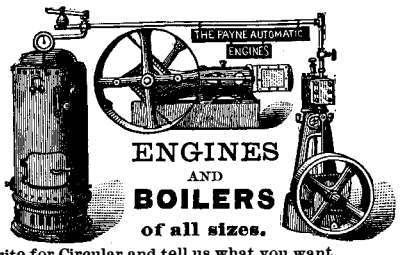

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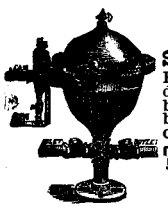

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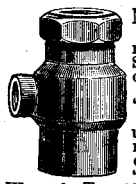

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We have received following letter in regard to one of our No. 5 "L" ($16) Steam Jet Pumps elevating 1¼ inch pipe of water more than 50 feet high:
"L'ANSE, MICH., Feb. 24, 1883.
"VAN DUZEN & TIFT, Cincinnati, O.:
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